

# Pocket Manual

for  
Dyers and Printers  
on

the application of

## The Coal-Tar Colours

of the

### Farbwerke

vorm.

Meister Lucius & Brüning  
Hoechst a/M.

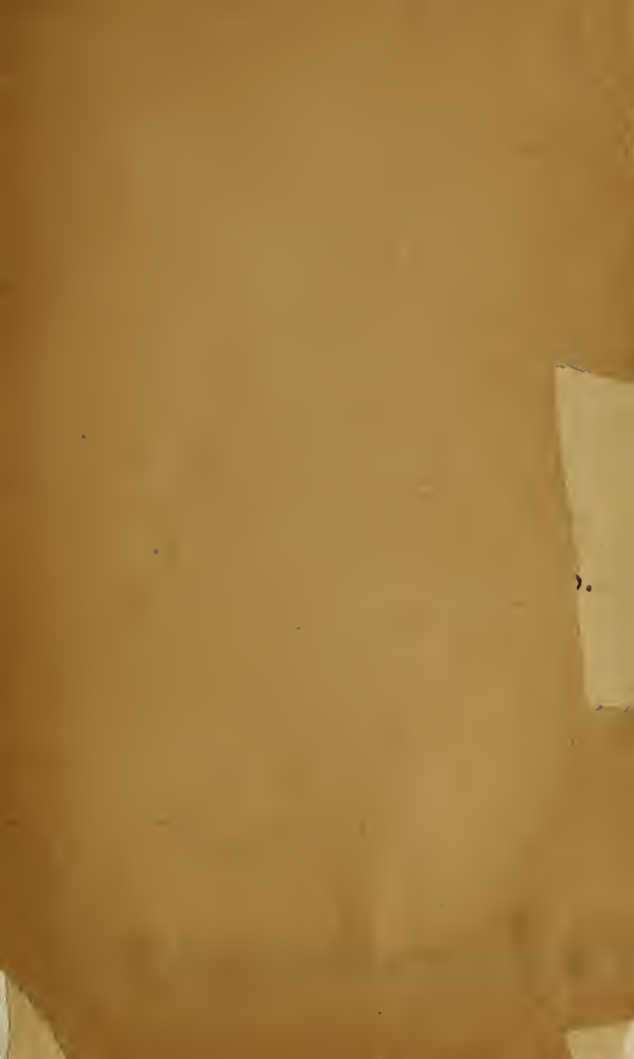
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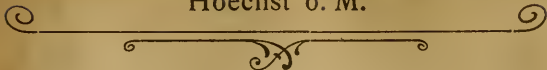






Farbwerke vorm. Meister Lucius & Brüning

Hoechst o. M.



# Pocket Manual

for

## Dyers and Printers

on

the application of

# The Coal Tar Colours.



Sole Agents for the U. S. A.

**H. A. METZ & CO.**

New York.

Boston, Mass.

Philadelphia, Pa.

Providence, R. I.

Chicago, Ills.

Charlotte, N. C.

Atlanta, Ga.

Newark, N. J.

Montreal, Canada.



# PREFACE.

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THIS work has been compiled for the use of our customers with the intention of serving as a handy reference book. It contains notes upon the application and characteristics of our products.

We have classified the contents, firstly, according to the different branches of the dyeing industries and, secondly, we have further subsidised the different headings as regards the employment and the properties of our colours.

This classification admits of quick information regarding the dyeing methods and fastness properties of each separate colour, and will also aid the dyer in his choice of dyestuffs, especially adapted to and suitable for a set purpose.

The manysidedness of the subject however, is so great that it is impossible to treat the different matter exhaustively or in detail,—and we can therefore scarcely warrant its exactness in every detail—but we hope at least that this book will serve the practical dyer as a guide and adviser when following his profession.

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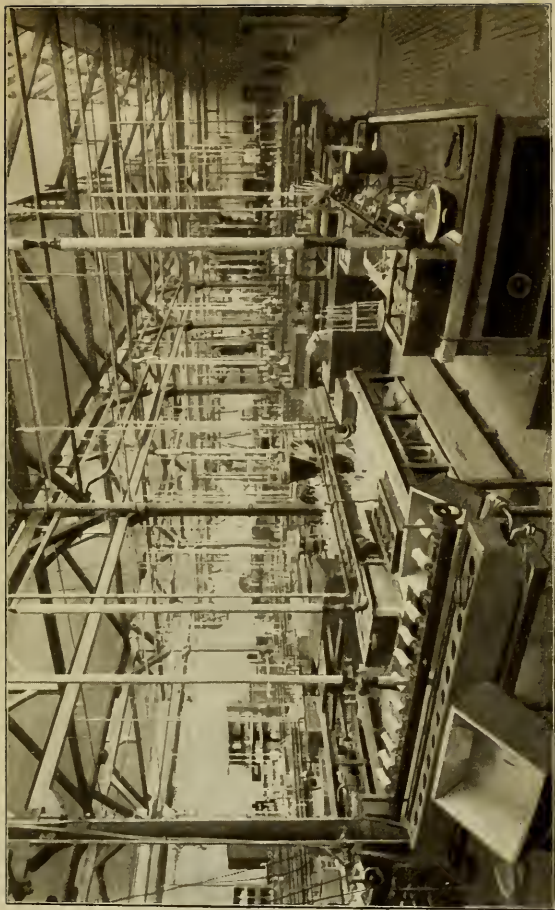




Dyehouse (exterior).

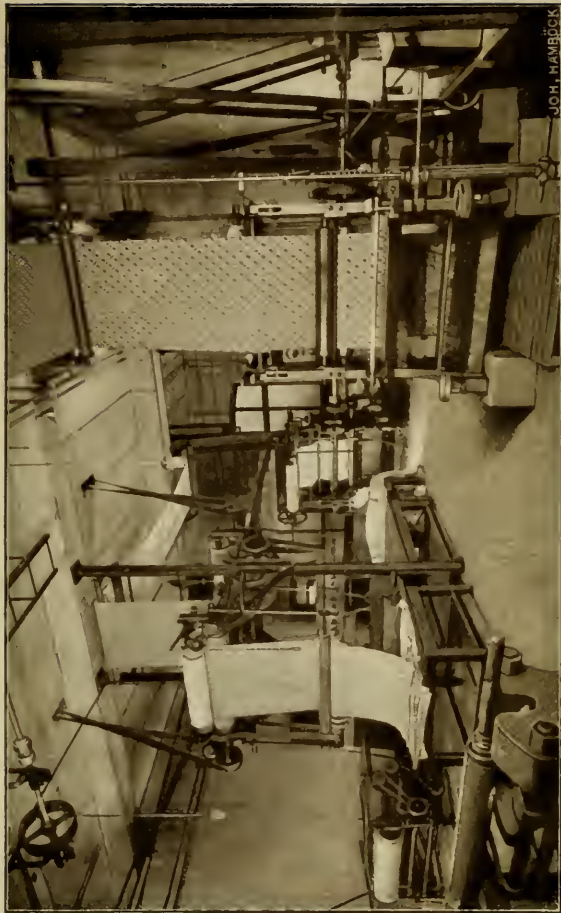






Dyehouse (interior).





Printing Department.



## A. WOOL DYEING.

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### a) Wool Colours, classified according to modes of dyeing.

#### 1. Wool Colours dyed in an acid bath.

The bath is prepared with 10% Glauber's salt and 4% sulphuric acid or 10% tartar substitute, and the necessary amounts of dyestuff; after entering the material, the temperature is raised to the boil and the dyeing operation finished by boiling for  $\frac{3}{4}$  to  $1\frac{1}{2}$  h. For dyestuffs which do not equalize well, more Glauber's salt and less or weaker acids are required.

**Acid Magenta**, all brands, **Acid Cerise O**, II, **Acid Maroon O**, **Maroon S**, **Orseilline R**, B.

**Soluble Blue**, all brands, **Bleu de Lyon**, all brands, **Guernsey Blue**, **Opal Blue**, **Blackley Blue**, all brands, **Cloth Blue O**, **Full Blue O**, **Navy Blue V**, **Opal Blue superior** (soluble) **Cotton Blue**, all brands, **Pure Blue**, all brands, **Cotton Lightblue O** soluble, **China Blue R**, 1, 2.

**Acid Violet 3RA**, 4RS, 3RS, II, R conc. new, N, 5BF, 5BFI, 7BN, **Neutral Violet O**.

**Acid Green O**, D, M, conc., conc. D, conc. M, II, **Acid Green** solution 5 times concentrated.

**Patent Blue**, all brands.

**Cyanine B**, B conc. patented.

**Keton Blue 4BN** solut, 4BN powder, pat.

**Patent Green O**, V, VS, patented.

**Naphthalene Green V**, conc., patented.

**Naphthalene Blue B**, B extra, D patented.

**Indigo Substitute BS**, B, WE, B extra, BS extra, pat., **Patent-Marine Blue** pat.

**Acid Rosamine A** pat., **Fast Acid Red A** pat., **Fast Acid Violet B**, R, A2R, pat., **Fast Acid Blue R**, R conc., pat., **Fast Acid Eosine G**, G extra pat., **Fast Acid Phloxine A**, A extra pat., **Fast Acid Magenta G**, G conc. pat.

**Fastblue**, all brands, **Black Blue O**, **Black-Black O**, **Fast-Darkblue R**, **Nigrosine No. I**, II, III, IV, A.

**Azo Acid Magenta G**, B, pat., **Azo Acid Carmine B** pat., **Alkali Fastred R** and B pat.

**Chromotrope G**, 2R, 2B, 6B, 7B, 8B, 10B pat.

Archil Substitute G pat., Amido Naphthol Red G, 6B.  
 Victoria Violet 4BS, 8BS pat., Azo Acid Blue B pat., Azo  
 Acid Black, all brands.  
 Naphthol Black D, Azo Black O, Amido Naphthol Black  
 4B, 6B, 4B extra, S.  
 Chinoline Yellow O, extra.  
 Naphthol Yellow S, SE.  
 Azo Yellow conc., O, R, Victoria Yellow O, double, conc.,  
 Metanil Yellow extra.  
 Flavazine T, S, L.  
 Orange, all brands. Brilliant Orange G, O, R.  
 Solid Brown O, Yellow shade, NT, L, Azo Brown V, Naph-  
 thol Brown O.  
 Scarlet, all brands, Brilliant Lake Scarlet G, R, RR, Scarlet  
 6R cryst.  
 New Coccine O, Coccine O, B.  
 Victoria Scarlet, all brands.  
 Brilliant Croceine, all brands.  
 Rocceline N, Fastred all brands.  
 Brilliant Crimson O, B, Brilliant Rubine O, Victoria Rubine  
 O, G.  
 Amaranth O, E.  
 Clothred O, Fast Claret Red O, Naphtho Rubine O,  
 Naphthol Red O.  
 Claret Red, all brands.  
 Rosazeine, all brands.  
 Red YB, Y, YG, Y2G pat.  
 Victoria Blue B.

## 2. Wool Colours dyed in an acid bath which excel as regards equalizing.

Patent Blue V, N, superior, L, G, B, J1, J2, J3, G conc., B  
 conc., patented.  
 Cyanine B, B conc., pat.  
 Naphthalene Green V, conc., pat.  
 Keton Blue 4BN solution, 4BN powder, pat.  
 Fast Acid Eosine G, G extra, pat., Fast Acid Phloxine A,  
 A extra, pat., Fast Acid Magenta G, G conc, pat.  
 Fast Acid Violet A2R, R, pat.  
 Chromotrope G, 2R, 2B, pat.  
 Azo Acid Magenta G, B, pat.  
 Amido Naphthol Red G, 6B.  
 Acid Violet N.  
 Chinoline Yellow O, extra.  
 Naphthol Yellow S, SE.  
 Flavazine S, L.  
 Azo Yellow conc., O, Victoria Yellow O, double, conc,  
 Orange G, No. 1, No. 2, No. 4, No. 4LL.  
 Brilliant Orange G, O.  
 Rosazeine O, B, OG, B extra, G extra.  
 Victoria Blue B.

### 3. Colours dyed in an acid bath which are developed with bichrome.

The bath is prepared with 3–6% sulphuric acid and 10–20% Glauber's salt or 20% tartar substitute and the necessary amounts of dyestuff; the material is entered at about 122° F, the temperature raised to the boil and boiling continued for 1 h.; then the bath is cooled down a little and the requisite amount of bichrome (3%) added; the bath is again heated to the boil and the shade developed by  $\frac{1}{2}$  to 1 h's boiling. For Chromotrope FB, F4B, S, SR, Chrome Brown RO and BO, — 2% sulphuric acid and 3% lactic acid are added to the bath along with the bichrome to obtain shades fast to milling.

Chromogene I, pat.

Chromotrope G, 2R, 2B, 7B, 8B, 10B, S, SB, SR, FB, F4B, pat.

Chrome Brown RO, BO, pat.

Acid Alizarine Red G pat.

Acid Alizarine Grenade R.

Acid Alizarine Violet N.

Acid Alizarine Blue GR, BB, pat.

Acid Alizarine Green G pat.

Acid Alizarine Blue Black B pat.

Acid Alizarine Grey G pat.

Acid Alizarine Black R, 3B, 3B extra, pat.

Acid Alizarine Brown B.

Ceruleine B paste, BWR pat.

Alizarine Red 1WS.

Alizarine Orange N, R, P.

Alizarine Yellow GGW powder, GGW paste, pat., RW powder, RW paste.

Mordant Yellow O.

Chrome Black B, T, pat. (developed with bichromate of potash and copper sulphate).

#### 3a. Acid Colours which may be used for shading off after chroming.

Patent Blue V, N, L, B, J1, J2, J3, G conc., B conc., A, A conc., patented.

Patent Green V, VS, pat.

Cyanine B, B conc., pat.

Naphthalene Green V, conc., pat.

Keton Blue 4BN solution, 4BN powder, pat.

Fast Acid Violet A2R, R pat., Fast Acid Red A pat.

Fast Acid Eosine G pat., Fast Acid Phloxine A pat.

Fast Acid Magenta G pat.

Acid Violet N, 5BF, 3RA, Black Blue O.

Chinoline Yellow O.

Flavazine L, S, T.

Azo Yellow O, conc., Victoria Yellow O., double, conc.

Orange G, No. 2, No. 4, No. 4 LL, Brilliant Orange G, O.

Amido Naphthol Red G, 6B.

Alkali Fastred R, B, pat.

#### 4. Wool Colours dyed in an acid bath which may be developed with fluoride of chrome.

The bath is prepared with 4—6 % sulphuric acid and 10—20 % Glauber's salt or 10—15 % tartar substitute and the necessary amounts of dyestuff; the material is entered at 122° F, the bath heated to the boil and boiling continued for 1 h.; then the bath is cooled a little, and the requisite amount (3 %) of fluoride of chrome added, the temperature is again raised to the boil. and the shade developed by boiling for about 1 h.

Chromotrope G, 2 R, 2 B, 6 B, 7 B, 8 B, 10 B, pat.

Victoria Violet 4BS, 8BS, pat., Azo Acid Blue B pat.

Acid Alizarine Brown B.

Acid Alizarine Red G pat.

Acid Alizarine Grenade R.

Acid Alizarine Violet N.

Acid Alizarine Blue GR, BB, pat.

Acid Alizarine Dark Blue SN pat.

Acid Alizarine Green G pat.

Acid Alizarine Grey G pat.

Acid Alizarine Black R, 3B, 3B extra, T, SE paste, pat.

Ceruleine B paste, BWR, pat.

Alizarine Red 1 WS.

Alizarine Orange N, R, P.

Alizarine Yellow GGW powder, GGW paste pat.

Mordant Yellow O.

#### 4a. Acid Colours which may be used for shading off after the addition of fluoride of chrome.

Patent Blue V, N, L, B, J1, J2, J3, G conc. B conc., A, A conc., pat.

Patent Green V, VS, pat.

Cyanine B, B conc., pat.

Naphthalene Green V, conc., pat.

Keton Blue 4BN solution and 4BN powder pat.

Fast Acid Violet A2 R, R pat., Fast Acid Red A pat.

Fast Acid Eosine G pat., Fast Acid Phloxine A pat.

Fast Acid Magenta G pat.

Acid Violet N, 5BF, 3RA, Blackblue O.

Chinoline Yellow O.



Flavazine S, L, T.

Azo Yellow O, conc., Victoria Yellow O, double conc.

Orange G, No. 2, No. 4, No. 4 LL, Brilliant Orange G and O.

Amido Naphthol Red G, 6B.

Alkali Fast Red R, B, pat.

## 5. Wool Colours dyed in an acid bath which may be developed with alum.

The bath is prepared with 3 to 4% sulphuric acid and 10% Glauber's salt and the necessary amounts of dyestuff; the material is entered at 122° F, the bath heated to the boil and boiling continued for 1 h.; then according to the depth of the shade 5 to 10% alum (free from iron) are added to the bath, and the shade developed by boiling for about 1 h.

Chromotrope G, 2R, 2B, 6B, 7B, 8B, 10B, pat.

Victoria Violet 4BS, 8BS, pat., Azo Acid Blue B pat.

Alizarine Red 1WS.

Alizarine Orange N, R, P.

Alizarine Yellow GGW powder, GGW paste pat.

## 5a. Acid Colours which may be used for shading off after developing with alum.

Patent Blue V, N, L, B, J1, J2, J3, G conc., B conc., A, A conc., pat.

Patent Green V, VS, pat.

Cyanine B, B conc., pat.

Naphthalene Green V, conc., pat.

Keton Blue 4BN solution, 4BN powder, pat.

Fast Acid Violet A2R, R pat., Fast Acid Eosine G pat.,

Fast Acid Phloxine A pat., Fast Acid Magenta G pat.

Rosazeine O, B, OG, extra, B extra, G extra.

Acid Violet N, 5BF, 3RA.

Chinoline Yellow O.

Flavazine S, L, T,

Azo Yellow O, conc., Victoria Yellow, O, double, conc.

Orange G, No. 2, No. 4, No. 4 LL, Brilliant Orange G, O.

Scarlet B extra, Scarlet R, 2R, 3R.

Alkali Fast Red R, B pat.

Amido Naphthol Red G, 6B.

## 6. Wool Colours dyed in an acid bath and developed with copper sulphate.

The bath is prepared with 30% Glauber's salt and 2—4% sulphuric acid or 20% Glauber's salt and 10% tartar substitute

and the necessary amounts of dyestuff: the material is entered at about  $100^{\circ}\text{F}$ , the bath slowly heated to the boil and boiling continued for 1 h; after cooling the bath a little, the necessary amounts of copper sulphate (1–3%) are added and the shade developed by boiling for another  $\frac{1}{2}$  h. In many cases the copper sulphate may be added to the bath at the beginning of the dyeing operation.

**Copper Red N.**

„ Blue B, B extra, pat.

„ Black S pat.

**Chrome Black B, T, pat.** (devel. with Chrome and Copper).

## 6a. Acid Colours which may be used for shading off after the addition of copper sulphate.

**Patent Blue V, N, L, B, J1, J2, J3, G conc., B conc., A, A conc., pat.**

**Patent Green V, VS, pat.**

**Cyanine B, B conc., pat.**

**Naphthalene Green V, conc., pat.**

**Keton Blue 4BN solution, 4BN powder, pat.**

**Fast Acid Violet A 2 R, R, pat., Fast Acid Red A pat.**

**Fast Acid Eosine G pat., Fast Acid Phloxine A pat., Fast Acid Magenta G pat.**

**Acid Violet N, 5BF, 3RA.**

**Chinoline Yellow O.**

**Flavazine S, L, T.**

**Azo Yellow O, conc., Victoria Yellow O, double, conc.**

**Orange G, No. 2, No. 4, No. 4LL, Brilliant Orange G, O.**

**Alkali Fast Red R, B, pat.**

**Amido Naphthol Red G, 6B.**

## 7. Wool Colours dyeing upon alum mordant.

**Mordanting:** The bath is prepared:

for dark shades with 3% tartar, 2% oxalic acid, 10% alum,

for light shades with  $1\frac{1}{2}\%$  „ 1% „ „ 5% „

the material is boiled for  $1\frac{1}{2}$  h whilst worked continuously, then rinsed and dyed.

**Dyebath:** For all dyestuffs stated below (with the exception of the different brands of Ceruleine, Alizarine Red 1WS, and Alizarine Yellow GGW, which are dyed with acetic acid) the bath is prepared with  $2\frac{1}{2}\%$  acetate of lime, 2% tannin, and the necessary amount of dyestuff which is previously stirred up and diluted with water. The material is entered, the bath gradually heated to the boil (within 1 h), and boiling continued for about  $1\frac{1}{2}$  h; then the material is rinsed and dried.

Alizarine Red all brands in paste and powder.  
 Alizarine Orange N, R, P, NL in paste and powder.  
 Ceruleine conc., paste A, paste SW, S, S conc.  
 Alizarine Brown R, S, RD, N, G, F, H, 1424, 1258.  
 Alizarine Yellow GGW, paste and GGW powder, pat.

## 8. Wool Colours dyeing upon chrome mordant.

### a) Ordinary method:

**Mordanting:** The bath is prepared with:

|                |    |                   |    |                   |
|----------------|----|-------------------|----|-------------------|
| 3% bichrome    | or | 3% bichrome       | or | 2% bichrome       |
| 2 1/2 % tartar |    | 1% sulphuric acid |    | 3% lactic acid    |
|                |    |                   |    | 1% sulphuric acid |

for hard water about 5% acetic acid 12° Tw. are added. The material is entered at about 158° F, and the bath heated to the boil (if lactic acid is used, the temperature must be raised slowly), and boiling continued for about 1 1/2 h. Before starting the dyeing operation, the material is slightly rinsed.

**Dyebath:** The bath is neutralized with 2 to 10% acetic acid 12° Tw. according to the degree of hardness of the water and the nature of the dyestuffs used; the material is entered into the cold bath, the temperature raised to the boil within 1 h, and boiling continued for 1 1/2—2 h.

Piece goods, which are dyed through with difficulty, also hats etc., are dyed with the addition of 5% acetate of ammonia at the boil for 1 1/2—3/4 h; then the necessary amount of acetic acid is added to the bath.

### b) Method for dyeing in mechanical dyeing apparatus.

**Mordanting:** The bath is prepared with 5% tartar and 8% alum, the material is boiled for 1 1/2 h, whilst continuously worked, and then slightly rinsed.

**Dyebath:** The bath is prepared with the necessary amounts of dyestuff, which is previously stirred up and diluted with water, and then added to the bath through a fine sieve, — also 2 to 3% ammonia is added, then the apparatus for circulating the dye liquid is set in motion and the temperature raised to the boil; after 1 h's boiling acetic acid is gradually added and boiling continued until the dyestuff is fixed.

### c) One bath method:

The bath is prepared with 1 1/2 % bichrome, 3% lactic acid, and 1% sulphuric acid; the material is entered at about 158° F, the temperature raised to the boil (within 1/2 h), and boiling continued for 1 h; then the bath is cooled to about 122° F, and some

ammonia added until the dye liquid is neutral; the requisite amounts of dyestuff are then added, and the bath heated to the boil; after  $\frac{1}{4}$  h's boiling some acetic acid is given into the bath and boiling continued until the dyebath is exhausted.

Alizarine Red, all brands in paste and powder.  
 Alizarine Orange N, R, P, NL in paste and powder.  
 Alizarine Brown, all brands in paste and powder.  
 Alizarine Blue DN, DNW, F, R, RR, A, B, 942, 942 G.  
 Alizarine Darkblue S, SV.  
 Alizarine Blue SB, SBW, SR, SRW, SBR, S2R.  
 Alizarine Claret R paste.  
 Alizarine Green S paste.  
 Alizarine Yellow paste.  
 Ceruleine paste B, BW conc., BWR powder pat.  
 Ceruleine conc., W powder, paste A, paste SW, S, S conc.  
 Galleine conc., W powder, R conc. powder, paste A, R, R double.  
 Alizarine Yellow GGW powder and GGW paste, pat.  
 Mordant Yellow O.

### 8a. Acid colours which are suitable for shading off at the boil upon material which was previously mordanted.

Patent Blue A pat.  
 Naphthalene Green V, conc., pat.  
 Fast Acid Blue R, R conc., pat.  
 Fast Acid Violet A2R, R, B, pat., Fast Acid Magenta G pat.,  
 Fast Acid Eosine G pat., Fast Acid Phloxine A pat.  
 Acid Violet N, 5BF, 3RA.  
 Flavazine S, L, T.  
 Azo Yellow O, conc.  
 Victoria Yellow O, double, conc.  
 Orange No. 2, No. 4, No. 4LL.  
 Brilliant Orange G, O, R.  
 Alkali Fast Red R. B pat.  
 Amido Naphthol Red G, 6B.

## 9. Wool Colours which dye wool in a soap bath.

The bath is prepared with 5% Olive Oil and the solutions of the requisite amounts of dyestuff; the material is dyed at 122–140° F for about 1 h; after dyeing the material is hydroextracted and finally stoved.

Magenta, all brands.  
 New Magenta O pat.  
 Methyl Violet, all brands.

**Victoria Blue B.**

**Methylene Blue and Marine Blue**, all brands.

**Brilliant Green**, all brands.

**Auramine**, patented, all brands,

**Safranine and Methylene Violet**, all brands.

**Rosolane O, T, R** paste, **B** paste, pat.

**Rosazeine O, B, OG**, extra, **B** extra, **G** extra.

## 10. Wool Colours which dye wool in a neutral bath, without any addition.

After adding some acetic acid to the bath in order to counteract carbonates of lime and magnesia, often present in the water, the colours are added, after previously diluting the dyestuff-solutions with water, and the material dyed at about 176—194° F.

**Magenta**, all brands, **New Magenta O** pat., **Cerise G, R.**

**Grenadine**, all brands, **Maroon O**, extra, **Cardinal R, G.**

**Phosphine**, all brands.

**Brilliant Green and Malachite Green**, all brands.

**Methyl Violet**, all brands, **Violet Crystals O.**

**Vesuvine**, all brands, **Chrysoidine A** cryst., **C** cryst.

**Auramine** conc., **O, I, II**, pat.

**Azo Phosphine GO, BRO**, pat.

**Victoria Blue B.**

**Rosolane**, all brands, pat.

## 11. Wool Colours which dye in an alkaline bath.

The bath is prepared with 5—10% Borax and the necessary amounts of dyestuff solution; the material is entered, the temperature raised to the boil and boiling continued for  $\frac{3}{4}$ —1 h. Then the goods are well rinsed and finally „soured“ in a bath containing about 5% Sulphuric Acid, by working them for  $\frac{1}{4}$  h at 84—147° F. Instead of Sulphuric Acid, Alum or Perchloride of Tin may be used for „souring“, which increases the fastness to milling.

**Alkaline Blue**, all brands.

**Methyl Alkaline Blue MLB.**

**Alkaline Violet O.**

## 12. Wool Colours which dye in an acetic acid bath.

The bath is prepared with 10% acetic acid 12° Tw., 10% acetate of soda, and the necessary amount of dyestuff; the material is

entered into the cold bath, the bath heated to  $176^{\circ}$  F (within  $\frac{1}{2}$  h), and the dyeing operation finished in about 1 h.

Eosine, all brands.

Erythrosine, all brands.

Phloxine, all brands.

Rose Bengale, all brands.

### 13. Wool Colours for Vat dyeing.

Indigo paste or powder is dyed in the Fermentation or Hydrosulphite Vat in exactly the same manner as the natural product. Indigo MLB Vat I is dyed in a Hydrosulphite Vat according to our own process, which is protected by patent:

#### a. Preparing the vat.

The cistern is filled with water of  $105-115^{\circ}$  F; ammonia is added until a slight alkaline reaction is noticeable and then the following ingredients are one by one poured into the vat containing about 300 gall.

1) 1 Gall. Glue solution 1:10.

2)  $1-1\frac{1}{2}$  Gall. Hydrosulphite.

3)  $\frac{1}{2}-1$  Gall. Indigo MLB Vat I (according to the depth of shade required).

If properly prepared the vat will show a green-yellowish appearance.

#### b. The dyeing of loose wool in an open vessel.

After preparing (setting) the vat, it is stirred a few times and the well wetted wool (about 60 lbs.) entered. Two men must move the wool slowly about, under the surface of the liquid for 15-20 min. Then it is taken out and well squeezed through a wringing apparatus attached to the cistern, and allowed to oxidise in the air; then it is put back into the vat without any more Indigo being added and treated as before.

If a very dark blue is required 1-2 pints of Bisulphite  $72^{\circ}$  Tw. diluted with water must be gradually sprinkled over the wool and the latter manipulated as before.

For further dyeing operations the vat must be neutralized in case Bisulphite has been added, but for very dark shades, which require considerable additions of Indigo MLB Vat I it is not absolutely necessary to neutralize the liquid beforehand.

#### c. The dyeing of slubbing in a mechanical apparatus.

After preparing the vat, about 100-200 lbs. of slubbing are put into the apparatus and the latter set in motion. After 5-10 min some Bisulphite, diluted with equal parts of water, is gradually

added through a dripping funnel, until the vat shows a slight acid reaction (Phenolphthaleine-Test.)

After about 15 min the apparatus is emptied and the slubbing then oxidised by treating it with cold water.

#### d. The dyeing of yarn in an open vessel.

This dyeing operation is only distinguished from the dyeing of loose wool by the difference in handling. A sufficiently deep yarn dyeing-cistern is used as a vessel. The yarns are hung on cords, or better still on bent  shaped iron rods and moved about under the liquid. Light and medium shades are dyed like loose wool in a slightly alkaline vat; for dark blues, Bisulphite is added for the second dip just before the material is entered. Whenever a darker shade is required it is always advisable to give two dips on account of the better equalization.

#### e. The dyeing of piece goods.

The dyeing of piece goods is best carried out in cisterns which contain an arrangement, by means of which the pieces pass over indiarubber rollers underneath the surface of the vat. Before dyeing the goods are well moistened, preferably on a „washer“, then hydroextracted and then entered into the vat and worked according to quantity and depth of shade required for 15–30 min. Then the pieces are taken out, squeezed through a broad-squeezing machine (wringer) and oxidised in the air by plating down, or by treating with cold water.

As is the case in dyeing loose wool and yarns, two dips are usually given and for very dark blues Bisulphite is added to the vat before the second dip, until the liquid reacts slightly acid.

**Indigo** MLB powder, pat.

„ MLB extra (99–100 %), pat. } suitable for Hydrosulphite

„ MLB Vat I 20 %, pat. } Vats

„ **White** MLB 40 %, pat.

„ MLB/G powder, pat. } suitable for Hydrosulphite and

„ MLB paste 20 %, pat. } Fermentation Vats.

### 14. Wool Colours which can only be dyed in copper vessels, if additions of sulphocyanide salts are made.

Naphthalene Blue B, B extra, D pat.

Victoria Violet 4BS, 8BS, pat., Azo Acid Blue B pat.

Azo Acid Black pat., all brands.

Chromotrope FB, F4B, pat.

Acid Aliz. Black R, 3B, 3B extra, T pat.

Acid. Aliz. Blue BB, GR, pat.

Acid. Aliz. Dark Blue SN pat.

Acid Aliz. Green G, pat.

Acid Aliz. Blueblack B pat.

## 15. Wool Colours, especially suitable for dyeing in a mechanical dyeing apparatus.

Indigo MLB Vat. I 20%, pat.  
 Indigo White MLB 40%, pat.  
 Chromogen I, pat.  
 Chromotrope FB, F4B, S, SB, SR, pat.  
 Acid Alizarine Red G pat.  
 Acid Alizarine Grenade R.  
 Acid Alizarine Violet N.  
 Acid Alizarine Blue BB, pat.  
 Acid Alizarine Blue Black B pat.  
 Acid Alizarine Green G pat.  
 Acid Alizarine Grey G pat.  
 Acid Alizarine Black R, 3B, 3B extra, T pat.  
 Acid Alizarine Brown B.  
 Alizarine Yellow GGW pat., Mordant Yellow O.  
 Chrome Black B, T, pat.  
 Alizarine Red, all brands.  
 Alizarine Orange, all brands.  
 Alizarine Brown, all brands.  
 Alizarine Blue „S“ brands, DNW.  
 Alizarine Claret R paste.  
 Patentblue A pat.  
 Fast Acid Violet A2R, pat., Fast Acid Blue R pat.  
 Flavazine S, L, T, Amido Naphthol Red G, 6B, and most  
 Acid dyestuffs.

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## b) Wool Colours classified according to specific properties.

### 1. Wool Colours which may be dissolved in the acidified dye liquid without any danger of spots etc.

Patent Blue V, N, superior, L, G conc., patented.  
 Cyanine B, B conc., pat., Keton Blue 4BN, solution, powder,  
 pat.  
 Naphthalene Green V, conc., pat.  
 Naphthalene Blue B, B extra pat.  
 Victoria Violet 4BS, 8BS, pat.  
 Azo Acid Blue B pat.



Chromotrope 2R, 6B pat.  
 Amido Naphthol Red G, 6B.  
 Orange G.  
 Flavazine T.  
 Chinoline Yellow O.

## 2. Wool Colours which must not be dissolved in the acidified dye liquid.

Soluble Blue, Bleu de Lyon. Blackley Blue, Guernseyblue  
 Opalblue, all brands.  
 Cloth Blue O, Full Blue O.  
 Alkaline Blue, all brands.  
 Cotton Blue, Pure Blue, all brands.  
 Acid Violet R, conc. new, N, 5BF, 5BFI, 7BN, Neutral  
 Violet O.  
 Fastblue, all brands, Blackblue O.  
 Nigrosine, all brands.  
 Rocceline N, Fastred O.  
 Fast Acid Violet A2R, R, B, pat., Fast Acid Blue R, R conc.,  
 pat., Acid Rosamine A pat.  
 Alizarine Yellow GGW, powder pat.  
 Alizarine Brown, all powder brands.  
 Galleine conc., W powder, R conc. powder.  
 Ceruleine conc., BW conc., BWR conc., pat.

## 3. Wool Colours, which leave cotton white.

Acid Magenta, all brands, Acid Violet 4RS, 3RS.  
 Acid Green, all brands.  
 Patent Blue V, N, L, LL, superior pat., Cyanine B pat., Keton  
 Blue 4BN pat.  
 Naphthalene Green V, conc., pat., Naphthalene Blue B, B  
 extra pat.  
 Chinoline Yellow O, extra.  
 Naphthol Yellow S, SE.  
 Flavazine T.  
 Orange G.  
 Scarlet R, 2R, 3R, 4R, 5R, 6R, Scarlet 6R cryst.  
 Victoria Rubine O, G, Naphthol Red O.  
 Victoria Scarlet 2R, 3R, 4R, 5R, 6R, New Coccine O.  
 Archil Substitute G pat.  
 Alkali Fast Red R pat., Azo Acid Carmine B pat.  
 Azo Acid Magenta G, B pat., Amido Naphthol Red G, 6B.  
 Chromotrope G, 2R, 2B, 6B, 8B, 10B pat.  
 Victoria Violet 4BS, 8BS, pat., Azo Acid Blue B pat.  
 Azo Acid Black B, G, 3BL, 3BL extra, BL, GL, TL conc., TL  
 extra pat.  
 Acid Aliz. Blue BB pat.

Acid Aliz. Green G pat.  
 Mordant Yellow O.  
 Aliz. Red 1 WS.  
 Chromogen I pat.  
 Chromotrope FB, F4B, 8B, 10B, S, pat.

#### 4. Wool Colours of great fastness to light.

Indigo MLB powder, pat.  
 Indigo MLB extra (99—100%), pat.  
 Indigo MLB/G powder, pat.  
 Indigo MLB paste 20%, pat.  
 Indigo MLB Vat I 20%, pat.  
 Indigo White MLB 40%, pat.  
 Alizarine Yellow paste.  
 Alizarine Yellow GGW powder, GGW paste, pat.  
 Mordant Yellow O.  
 Alizarine Orange, all brands.  
 Alizarine Red 1 WS powder, 1 W, 4 FW.  
 Alizarine Claret R paste.  
 Alizarine Blue, all brands.  
 Alizarine Brown, all brands.  
 Ceruleine, all brands.  
 Chromotop FB, F4B, S, SB, SR, pat.  
 Acid Alizarine Black R, 3B, 3B extra, T, SE paste pat.  
 Acid Alizarine Brown B.  
 Acid Alizarine Red G pat.  
 Acid Alizarine Grenade R.  
 Acid Alizarine Violet N.  
 Acid Alizarine Blue BB, GR, pat., Acid. Aliz. Darkblue SN pat.  
 Acid Alizarine Grey G pat.  
 Acid Alizarine Blueblack B, pat.  
 Chromogen I pat.  
 Flavazine L.  
 Brilliant Croceïne yellow shade, blue shade.  
 Cloth Red O, Fast Claret Red O.  
 Alkali Fastred R, B, pat., Azo Acid Carmine B pat.  
 Chromotrope 2R pat., Amido Naphthol Red G, 6B.  
 Azo Acid Magenta B, G, pat.  
 Fast Acid Violet R, A2R pat.

#### 5. Wool Colours fast to stoving.

Auramine, all brands.  
 Phosphine, all brands.  
 Magenta, all brands, New Magenta O pat.  
 Methyl Violet, all brands, Violet crystals O.  
 Victoria Blue B.  
 Brilliant Green, all brands.  
 Rosazeïne, all brands.  
 Eosine, all brands, Erythrosine, all brands, Phloxine, all brands,  
 Rose Bengale, all brands.  
 Fast Acid Eosine G pat., Fast Acid Phloxine A pat., Fast  
 Acid Magenta G pat.

Acid Rosamine A pat., Fast Acid Red A pat.  
 Fast Acid Violet A2R, R, B, pat., Fast Acid Blue R, R  
 conc., pat.  
 Acid Violet N, 5BF, 5BFI, 7BN, Neutral Violet O.  
 Patent Blue, all brands, pat., Cyanine B, B conc., pat.  
 Keton Blue 4BN solution, 4BN powder, pat., Patentgreen VS pat.  
 Fastblue, all brands, Blackblue O, Black Black O, Fast  
 Darkblue R.  
 Chinoline Yellow O.  
 Naphthol Yellow S, SE.  
 Flavazine S, L, T.  
 Azo Yellow O, conc., Victoria Yellow O, double, conc.  
 Orange G, R, No. 1, No. 2, No. 4, No. 4LL, Brilliant Orange  
 G, O, R.  
 Scarlet GG, G, GRIL, R, RR, 3R, 3R superior, 4R.  
 Brilliant Rubine O, Brilliant Crimson O, B.  
 Alkali Fastred R, B, pat., Azo Acid Carmine B pat.  
 Azo Acid Magenta G, B, pat., Archil Substitute G pat.  
 Amido Naphthol Red G, 6B.  
 Chromotrope G, 2R, 2B, 6B, 8B, 10B pat.  
 Victoria Violet 4BS, 8BS, pat, Azo Acid Blue B pat.  
 Azo Acid Black, all brands, pat.  
 Chromotrope S, SB, SR, pat.  
 Chromotrope FB, F4B, 8B, 10B, pat.  
 Chrome Brown RO, BO, pat.  
 Chrome Black B, T, pat.  
 Acid Alizarine Black R, 3B, 3B extra, T, SE paste, pat.  
 Acid Alizarine Blueblack B pat.  
 Acid Alizarine Grey G pat.  
 Acid Alizarine Brown B, D.  
 Acid Alizarine Grenade R.  
 Acid Alizarine Red G pat.  
 Acid Alizarine Violet N.  
 Acid Alizarine Blue BB, GR, pat.  
 Acid Alizarine Darkblue SN pat.  
 Acid Alizarine Green G pat.  
 Alizarine Yellow GGW, powder, GGW paste, pat.  
 Alizarine Red 1WS (developed with Chrome).  
 Alizarine Claret R paste.  
 Alizarine Blue, all brands.  
 Ceruleine paste A, SW, B pat.  
 Indigo MLB powder, pat.  
 Indigo MLB extra (99—100%), pat.  
 Indigo MLB/G powder, pat.  
 Indigo MLB paste 20%, pat.  
 Indigo MLB Vat I 20%, pat.  
 Indigo White MLB 40%, pat.

## 6. Wool Colours fast to boiling in acids.

Chromogen I pat.  
 Copper Blue B extra pat.  
 Acid Alizarine Black SE paste pat.  
 Alizarine Blue, all brands.

Ceruleine paste A, SW paste, S, conc.  
 Indigo MLB powder, pat.  
 Indigo MLB extra (99—100%), pat.  
 Indigo MLB/G powder, pat.  
 Indigo MLB paste 20%, pat.  
 Indigo MLB Vat I 20%, pat.  
 Indigo White MLB 40%, pat.

## 7. Wool Colours of great fastness to washing.

Methyl-Violet, all blue brands, 2B, 3B etc.  
 Violet cryst. O.  
 Victoria Blue B.  
 Rosazeine, all brands.  
 Eosine, all brands, Erythrosine, all brands, Phloxine, all brands, Rose Bengale, all brands.  
 Fast Acid Eosine G pat., Fast Acid Phloxine A pat., Fast Acid Magenta G pat.  
 Acid Rosamine A pat., Fast Acid Violet A2R, R, B, pat.  
 Fast Acid Blue R, R conc., pat.  
 Acid Violet N, 5BF, 5BFI, Neutral Violet O.  
 Patent Blue all brands pat., Cyanine B, pat.  
 Keton Blue 4BN solution, 4BN powder, pat.  
 Indigo Substitute WE pat.  
 NaphthaleneGreenV, conc.pat., Naphthalene Blue B, B extr.,pat.  
 Fastblue, all brands.  
 Chrysoïne G.  
 Scarlet R, 2R, 3R, 3R superior, 4R, 5R.  
 Scarlet B extra, Clothred O, Fast Claret Red O.  
 Azo Acid Carmine B pat.  
 Victoria Violet 4BS, 8BS, pat., Azo Acid Blue B pat.  
 Chromotrope 2B, 7B, 8B, 10B pat. (devel. with Chrome),  
 Chromotrope S, SB, SR, FB, F4B pat.  
 Chromogen I pat., Chrome Brown RO, BO pat.  
 Chrome Black B, T, pat.  
 Copper Blue B, Bextra, pat., Copper Black S pat., Copper Red N.  
 Acid Alizarine Black R, 3B, 3B extra, T, SE pasie pat.  
 Acid Alizarine Blueblack B pat.  
 Acid Alizarine Grey G pat.  
 Acid Alizarine Brown B.  
 Acid Alizarine Red G pat.  
 Acid Alizarine Violet N.  
 Acid Alizarine Grenade R.  
 Acid Alizarine Blue BB, GR, pat.  
 Acid Alizarine Darkblue SN pat.  
 Acid Alizarine Green G pat.  
 Alizarine Yellow GGW, RW, pat.  
 Mordant Yellow O.  
 Alizarine Yellow paste.  
 Alizarine Orange, all brands.  
 Alizarine Red, all brands.  
 Alizarine Claret R paste, Alizarine Brown, all brands.

Alizarine Blue, all brands, Alizarine Darkblue S paste.  
 Alizarine Green S paste, pat.  
 Galleïne, all brands, Ceruleïne, all brands.  
 Indigo MLB powder, pat.  
 Indigo MLB extra (99—100%), pat.  
 Indigo MLB/G powder, pat.  
 Indigo MLB paste 20%, pat.  
 Indigo MLB Vat I 20%, pat.  
 Indigo White MLB 40%, pat.

## 8. Wool Colours which are not acted upon by street dirt.

Phosphine, all brands.  
 Magenta, Cerise, Grenadine, all brands, Maroon O, extra.  
 New Magenta O pat.  
 Methyl Violet, all brands, Violet crystals O.  
 Victoria Blue B.  
 Rosazeïne, all brands.  
 Eosine, all brands, Erythrosine, all brands, Phloxine all brands,  
 Rose Bengale, all brands.  
 Fast Acid Red A pat., Fast Acid Magenta G pat.  
 Acid Rosamine A pat., Fast Acid Violet A 2 R, R, B, pat.  
 Fast Acid Blue R, R conc., pat.  
 Acid Violet N, 5BF, 5BFI, Neutral Violet O.  
 Patent Blue, all brands, Patent Green V, VS, pat., Indigo Sub-  
 stitute B, BS, BS extra, WE, pat.  
 Cyanine B, B conc., pat.  
 Keton Blue 4BN solution, 4BN powder, pat.  
 Naphthalene Green V, conc., pat., Naphthalene Blue B, B  
 extra, pat.  
 Fast Blueblack O, Fast Darkblue R, Black Black O.  
 Chinoline Yellow O, Naphthol Yellow S, SE.  
 Flavazine S, L, T.  
 Azo Yellow O, conc., R, Chrysoine G, Victoria Yellow O,  
 double, conc.  
 Orange G, R, No. 1, No. 2, No. 4, No. 4LL, Brilliant Orange  
 G, O, R.  
 Scarlet GG, G, GR, R, RR, 3R, 3R superior, 4R, 5R, 6R.  
 Scarlet 6R cryst.  
 Victoria Scarlet, all brands, Scarlet B extra.  
 Brilliant Croceïne and Paper Scarlet, all brands.  
 Coccinine O, B, New Coccine O.  
 Victoria Rubine O, G, Brilliant Rubine O, Brilliant  
 Crimson O, B.  
 Rocceline N, Fast Red, all brands, Amaranth, all brands.  
 Claret Red, all brands, Naphthol Red O, Naphtho Rubine O.  
 Cloth Red O, Fast Claret Red O, Solid Brown O.  
 Azo Acid Carmine B pat., Alkali Fast Red R, B, pat.  
 Azo Acid Magenta G, B pat.  
 Amido Naphthol Red G, 6B.

Victoria Violet 4BS, 8BS, pat., Azo Acid Blue B pat., Azo  
 Acid Black, all brands, pat.  
 Amido Naphthol Black 4B, 4B extra, 6B, S.  
 Chromotrope 2B, 7B, 8B, 10B (developed with bichrome).  
 Chromotrope FB, F4B, S, SB, SR, pat.  
 Chromogen I pat., Chrome Brown RO, BO, pat.  
 Chrome Black B, T pat.  
 Copper Blue B extra pat.  
 Copper Red N.  
 Acid Alizarine Black R, 3B, 3B extra, T, SE paste, pat.  
 Acid Alizarine Grey G pat.  
 Acid Alizarine Blueblack B pat.  
 Acid Alizarine Brown B.  
 Acid Alizarine Grenade R.  
 Acid Alizarine Blue BB pat., (developed with bichrome).  
 Acid Alizarine Darkblue SN, pat.  
 Acid Alizarine Red G pat.  
 Acid Alizarine Violet N.  
 Acid Alizarine Green G pat.  
 Alizarine Yellow GGW, RW, pat. Mordant Yellow O.  
 Alizarine Yellow paste.  
 Alizarine Orange, all brands, Alizarine Red, all brands.  
 Alizarine Grenade R paste, Alizarine Brown, all brands.  
 Alizarine Blue, all brands, Alizarine Darkblue S paste,  
 Alizarine Green S paste pat.  
 Galleïne, all brands.  
 Ceruleïne, all brands.  
 Indigo MLB powder, pat.  
 Indigo MLB extra (99–100%), pat.  
 Indigo MLB/G powder, pat.  
 Indigo MLB paste 20%, pat.  
 Indigo MLB Vat. I 20%, pat.  
 Indigo White MLB 40%, pat.

## 9. Wool Colours suitable for milling in cold water.

Eosine, all brands, Erythrosine, all brands, Phloxine, all brands,  
 Rose Bengale, all brands.  
 Fast Acid Violet B, R, A2R, pat., Acid Rosamine A pat.,  
 Fast Acid Blue R, R conc., pat.  
 Acid Violet 7BN, 5BF, 5BFI.  
 Alkaline Blue, all brands.  
 Patent Blue A, AJ1, pat., Indigo Substitute WE pat.  
 Naphthalene Blue B, B extra, pat.  
 Flavazine T.  
 Scarlet R, 2R, 3R, 4R, 5R, 6R.  
 Scarlet 6R crystals, Scarlet B extra.  
 Victoria Scarlet RR, 2RB, 3R, 4R, 5R, 6R, RX, 2RX, 3RX.  
 Brilliant Croceïne and Paper Scarlet, all brands.  
 New Coccine O, Coccinine O, B.

Victoria Rubine O, Naphthol Red O, Amaranth, all brands.  
 Claret Red, all brands, Cloth Red O, Fast Claret Red O.  
 Azo Acid Carmine B pat., Alkali Fast Red R, B pat.  
 Victoria Violet 4BS, 8BS, pat., Azo Acid Blue B pat.  
 Copper Blue B, B extra, pat., Copper Red N.  
 Copper Black S pat.  
 Amido Naphthol Black 4B, 4B extra, 6B, S.  
 Indigo MLB powder, pat.  
 Indigo MLB extra (99—100%), pat.  
 Indigo MLB/G powder, pat.  
 Indigo MLB paste 20%, pat.  
 Indigo MLB Vat I 20%, pat.  
 Indigo White MLB 40%, pat.  
 All Alizarine, Mordant, Chrome developing, and Acid Aliz.  
 Colours.

## 10. Wool Colours suitable for light milling in soap.

Magenta, all brands.  
 Methyl Violet, all brands, Violet crystals O.  
 Victoria Blue B.  
 Rosazeïne, all brands.  
 Eosine, all brands, Erythrosine, all brands, Phloxine, all brands,  
 Rose Bengale, all brands.  
 Fast Acid Eosine G pat., Fast Acid Phloxine A pat., Fast  
 Acid Magenta G pat.  
 Acid Rosamine A pat., Fast Acid Violet A2R, R, B, pat.,  
 Fast Acid Blue R, R conc., pat.  
 Acid Violet N, 5BF, 5BFI, Neutral Violet O.  
 Alkaline Blue, all brands  
 Patent Blue, all brands, Cyanine, B, B conc., pat.  
 Keton Blue 4BN pat.  
 Indigo Substitute WE pat.  
 Naphthalene Green V, conc., pat., Naphthalene Blue B, B  
 extra, pat.  
 Fastblue, all brands.  
 Chinoline Yellow O.  
 Flavazine T.  
 Scarlet R, RR, 3R, 4R, 5R, 6R, B extra.  
 Brilliant Croceïne, Paper Scarlet, all brands.  
 Fastred O, S, Cloth Red O, Fast Claret Red O, Claret Red  
 R, R extra.  
 Azo Acid Carmine B pat.  
 Copper Blue B, B extra, pat., Copper Red N, Copper Black S pat.  
 Indigo MLB powder, pat.  
 Indigo MLB extra (99—100%), pat.  
 Indigo MLB/G powder, pat.  
 Indigo MLB paste 20%, pat.  
 Indigo MLB Vat I 20%, pat.  
 Indigo White MLB 40%, pat.  
 All Alizarine, Mordant, Chrome developing, and Acid Aliz.  
 Colours.

## 11. Wool Colours suitable for the ordinary milling process.

|                                                                         |                                                                                    |
|-------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| Fast Acid Violet A2R, R pat.                                            | } after-treated with Bichrome<br>or as shading-off-colours in<br>small quantities. |
| Acid Rosamine A pat.,                                                   |                                                                                    |
| Fast Acid Blue R, R conc., pat.                                         |                                                                                    |
| Acid Violet 5BF, 5BF1.                                                  |                                                                                    |
| Patent Blue A pat.                                                      |                                                                                    |
| Chromotrope FB, F4B, S, SR, pat. (with Lactic Acid).                    |                                                                                    |
| Chrome Brown RO, BO, pat. (with Lactic Acid).                           |                                                                                    |
| Chromogen I pat.                                                        |                                                                                    |
| Chrome Black B, T pat.                                                  |                                                                                    |
| Acid Alizarine Black R, 3B, 3B extra, T, SE paste, pat.                 |                                                                                    |
| Acid Alizarine Blue Black B pat., Acid Aliz. Grey G pat.                |                                                                                    |
| Acid Alizarine Brown B, Acid Aliz. Grenade R.                           |                                                                                    |
| Acid Alizarine Blue BB, GR, pat. (devel. with Bichromate<br>of potash). |                                                                                    |
| Acid Alizarine Green G pat.                                             |                                                                                    |
| Alizarine Yellow paste.                                                 |                                                                                    |
| Alizarine Yellow GGW, RW, pat., Mordant Yellow O.                       |                                                                                    |
| Alizarine Orange, all brands. Aliz. Red, all brands.                    |                                                                                    |
| Alizarine Claret R paste, Aliz. Brown, all brands.                      |                                                                                    |
| Alizarine Blue, all brands, Aliz. Darkblue S paste.                     |                                                                                    |
| Alizarine Green S paste pat.                                            |                                                                                    |
| Galleïne, all brands, Ceruleïne, all brands.                            |                                                                                    |
| Indigo MLB powder, pat.                                                 |                                                                                    |
| Indigo MLB extra (99—100%), pat.                                        |                                                                                    |
| Indigo MLB/G powder, pat.                                               |                                                                                    |
| Indigo MLB paste 20%, pat.                                              |                                                                                    |
| Indigo MLB Vat I 20%, pat.                                              |                                                                                    |
| Indigo White MLB 40%, pat.                                              |                                                                                    |

## 12. Wool Colours suitable for very severe milling.

Alizarine Yellow paste.  
 Alizarine Orange, all brands.  
 Alizarine Red, all brands.  
 Alizarine Claret R paste.  
 Alizarine Brown, all brands.  
 Alizarine Blue, all brands.  
 Alizarine Darkblue S paste.  
 Galleïne, all brands.  
 Ceruleïne, all brands.  
 Alizarine Green S paste pat.  
 Chromogen I pat.  
 Acid Alizarine Black SE paste, pat.  
 Acid Alizarine Blueblack B pat., Acid Aliz. Grey G pat.  
 Acid Alizarine Brown B.  
 Acid Alizarine Grenade R, Acid Alizarine Red G pat.,  
 Acid Alizarine Violet N.



Alizarine Yellow GGW pat., Mordant Yellow O.  
 Indigo MLB powder, pat.  
 Indigo MLB extra (99—100), pat.  
 Indigo MLB/G powder, pat.  
 Indigo MLB paste 20%, pat.  
 Indigo MLB Vat I 20%, pat.  
 Indigo White MLB 40%, pat.

### 13. Wool Colours which stand dry steaming.

All Dystuffs with exception of: Auramine, Acid Magenta, Acid Violet 4RS, 3RS, 1I, R conc., new., Alkaline Blue, Soluble Blue, Cotton Blue, Malachite Green, Brilliant-Green, Acid Green, Azo Yellow, Scarlet 5R, B extra, Brilliant Croceine, Paper Scarlet, Chromotrope 7B, 2B, pat.

### 14. Wool Colours which stand wet steaming.

Alizarine Yellow paste.  
 Mordant Yellow O.  
 Alizarine Orange, all brands, Alizarine Red, all brands.  
 Alizarine Grenade R paste, Alizarine Brown, all brands.  
 Alizarine Blue, all brands, Alizarine Darkblue S paste, Alizarine Green S paste pat.  
 Ceruleine, all brands, Galleine, all brands.  
 Acid Alizarine Brown B, Acid Alizarine Grenade R., Acid Alizarine Red G pat.  
 Acid Alizarine Grey G pat. (devel. with Bichromate of potash).  
 Acid Alizarine Blue BB pat. (devel. with Bichromate of potash).  
 Acid Alizarine Green G pat.  
 Acid Alizarine Black SE paste, pat.  
 Chromotrope FB, F4B. S, SR. pat. (with Lactic Acid).  
 Chromogen I pat.  
 Indigo MLB powder, pat.  
 Indigo MLB extra (99—100%), pat.  
 Indigo MLB/G powder, pat.  
 Indigo MLB paste 20%, pat.  
 Indigo MLB Vat I 20%, pat.  
 Indigo White MLB 40%, pat.

### 15. Wool Colours which can be carbonized with Sulphuric Acid, and are fast to milling.

Alizarine Orange, all brands.  
 Alizarine Claret R paste.  
 Alizarine Blue, all brands, Aliz. Darkblue S paste.

Ceruleine conc., S, S conc.  
 Milling Yellow O.  
 Chromogen I pat.  
 Chrome Brown RO, BO, pat. (with Lactic Acid).  
 Chromotrope FB, F4B, S, SR pat. (with Lactic Acid).  
 Acid Aliz. Black SE paste, pat.  
 Acid Aliz. Brown B, Acid Aliz. Grenade R.  
 Acid Alizarine Red G pat.  
 Chrome Black B, T, pat.  
 Acid Aliz. Grey G pat.  
 Acid Alizarine Blue BB pat. (developed with Bichrome).  
 Acid Alizarine Green G pat.  
 Patent Blue A pat.  
 Fast Acid Violet A2R, R, B, pat.  
 Fast Acid Blue R, R conc., pat.  
 Indigo MLB powder, pat.  
 Indigo MLB extra (99—100%), pat.  
 Indigo MLB/G powder, pat.  
 Indigo MLB paste 20%, pat.  
 Indigo MLB Vat I 20%, pat.  
 Indigo White MLB 40%, pat.

## 16. Wool Colours suitable for piece dyeing fast to carbonizing with Sulphuric acid.

All Colours with exception of: Eosine, all brands, Erythrosine, all brands, Phloxine, all brands, Rose Bengale, all brands, Copper Black S, Copper Blue B and B extra, Copper Red N, Mordant Yellow O, Alizarine Yellow paste, Ceruleine B paste, BWR paste, BWR conc., Aliz. Red, all brands on Chrome and Alum-Mordant, Aliz. Brown, all brands, Galleine, all brands.

## 17. Wool Colours with yellow nitric acid reaction.

Erythrosine, all brands, Phloxine, all brands.  
 Rose Bengale, all brands.  
 Acid Magenta, all brands, Acid Violet 4 RS, 3 RS, N, 5 BF, 5 BF1.  
 Neutral Violet O.  
 Soluble Blue SV.  
 Acid Green, all brands (reaction a dull yellow).  
 Patent Blue V, N, L, superior, B, pat.  
 Patent Blue, J-brands, A, AJI, patented (reaction a dull yellow).  
 Patent Green O, V, VS, pat. (reaction a dull yellow).  
 Cyanine B, Keton Blue 4 BN solut., 4 BN powder, pat. (reaction a dull yellow).  
 Naphthalene Green V, conc., pat. (reaction an orange-yellow).  
 Indigo Substitute B, BS, WE, patented (reaction a dull yellow).  
 Flavazine S, L, T.  
 Chromotrope 2R pat.

**Azo Acid Carmine B** pat. (reaction a dull yellow with a blueish edge).  
**Aliz. Red 1WS**, on Alum-Mordant or developed with Alum.  
**Aliz. Blue**, all brands (reaction dull yellow).  
**Galleine**, all brands (reaction dull yellow).  
**Ceruleine** conc., S, S conc., paste A, paste SW (reaction a reddish yellow).  
**Indigo MLB** powder, pat.  
**Indigo MLB extra** (99—100%), pat.  
**Indigo MLB/G** powder, pat.  
**Indigo MLB** paste 20%, pat.  
**Indigo MLB Vat I** 20%, pat.  
**Indigo White MLB** 40%, pat.

## 18. Wool Colours which change only slightly or not at all when spotted with muriatic acid.

**Acid Violet 3RS, 4RS, 7BN.**  
**Methyl Alkaline Blue MLB, Alkaline Blue 2B—6B.**  
**Opal Blue**, blue shade, green shade, superior soluble.  
**Fastblue**, all brands, **Black Blue O, Fast Darkblue R.**  
**Fast Acid Eosine G, G extra**, pat., **Fast Acid Phloxine A** pat.  
**Fast Acid Magenta G** pat., **Fast Acid Violet R, A2R,**  
**Acid Rosamine A** pat., **Fast Acid Blue R, R conc.**, pat.  
**Chinoline Yellow O.**  
**Flavazine S, L, T.**  
**Orange G, R, No. 2, Brilliant Orange G, O.**  
**Scarlet**, all brands, **GG—4R, 6R, Scarlet 6R** cryst.  
**Victoria Scarlet**, all brands, **New Coccine O, Coccine O, B.**  
**Victoria Rubine O, G, Brilliant Rubine O, Brilliant Crim-**  
**son O, B, Naphthol Red O, Amaranth**, all brands.  
**Claret Red G, G extra, Solid Brown O.**  
**Archil Substitute G** pat.  
**Chromotrope 2R, 2B, 8B, 10B**, pat.  
**Amido Naphtol Red G, 6B.**  
**Amido Naphtol Black 4B, 4B extra, 6B, S.**  
**Chromogen I** pat., **Chrome Brown RO, BO**, pat.  
**Chrome Black B, T**, pat.  
**Chromotrope 7B, 8B, 10B, S, SR, FB, F4B** pat. (devel. with Bichromate of potash).  
**Acid Aliz. Brown B, Acid Aliz. Grenade R.**  
**Acid Aliz. Red G** pat., **Acid Aliz. Violet N.**  
**Acid Aliz. Grey G** pat. **Acid Aliz. Blue Black B** pat.  
**Acid Aliz. Black R, 3B, 3B extra, T, SE** paste, pat.  
**Aliz. Blue**, all brands.  
**Indigo MLB** powder, pat.  
**Indigo MLB extra** (99—100%), pat.  
**Indigo MLB/G** powder, pat.  
**Indigo MLB** paste 20%, pat.  
**Indigo MLB Vat I** 20%, pat.  
**Indigo White MLB** 40%, pat.

## 19. Wool Colours suitable for acid milling.

Indigo MLB powder, pat.  
 Indigo MLB extra (99—100%), pat.  
 Indigo MLB/G powder, pat.  
 Indigo MLB paste 20%, pat.  
 Indigo MLB Vat I 20%, pat.  
 Indigo White MLB 40%, pat.  
 Chromotrope S, SR, FB, F4B, pat.  
 Chrome Brown RO, BO, pat.  
 Chromogen I pat.  
 Chrome Black B pat.  
 Acid. Aliz. Black R, SE paste, pat.  
 Acid Aliz. Red G pat., Acid. Aliz. Grenade R, Acid. Aliz.  
     Violet N.  
 Acid Aliz. Grey G pat, Acid Aliz. Blue Black B pat.  
 Acid Aliz. Blue BB pat., Acid Aliz. Darkblue SN pat.  
 Acid Aliz. Green G pat.  
 Aliz. Blue, R, R conc., pat.  
 Ceruleine conc., S, S conc., paste A, paste SW.  
 Fast Acid Blue R, R conc., pat.  
 Fast Acid Violet R, A2R, pat.  
 Patent Blue A pat.  
 Flavazine T.

## B. COTTON DYEING.

### a) Cotton Colours classified according to method of dyeing.

#### 1. Cotton Colours dyed in a neutral bath.

The bath is prepared for light shades (1% dyestuff) with 1 to 10% common salt or calc. Glauber's salt, for medium shades (1 to 2% dyestuff) with 10 to 15% common salt, and for dark shades (2 to 4% dyestuff or more) with 15 to 25% common salt. Light shades are dyed at 86 to 140° F, medium or dark shades are dyed at the boil for 1 h.

Dianil Yellow G, R, 2R, 3G pat.

Dianil Direct Yellow S.

Aurophenine O.

Oxydianil Yellow O.

Primuline O.

Dianil Orange N, G pat.

Toluylene Orange R.

Dianil Red R, 4B, 10B.

Dianil Brown R, BD.

Brilliant Dianil Red R, R conc.

Delta Purpurine 5B.

Dianil Blue G, B, R, 2R, 3R, 4R, E, ET, BX, pat.

Dianil Dark Blue 3R pat.

Dianil Black E, RN extra, pat.

N.B. When dyeing in concentrated, baths on the Jigger or in apparatus, less salt and soda is required. The proper amount of salt necessary is best ascertained by twaddling. The dyebath after being cooled down to 59 to 68° F should show

for light shades 1.<sup>4</sup> to 2.<sup>80</sup> Tw.

for medium shades 2.<sup>8</sup> to 4.<sup>40</sup> Tw.

for deep shades 4.<sup>4</sup> to 5.<sup>80</sup> Tw.

#### 2. Cotton Colours dyed in a weak alkali bath.

The dyebath is prepared as described above (under No. 1), with the addition of 1 to 2% soda.

Dianil Yellow 3G, G, R, 2R, pat.  
 Dianil Direct Yellow S.  
 Aurophenine O.  
 Oxydianil Yellow O.  
 Primuline O.  
 Dianil Orange G, F, R pat., N, Toluylene Orange R.  
 Dianil Scarlet G, 2R pat.  
 Dianil Red R, 4B, 10B, Dianil Claret Red B, G, Dianil  
 Magenta O.  
 Brilliant Dianil Red R, R conc., Delta Purpurine 5B.  
 Dianil Brown 5G, 3GO, 2G, G, R, 3R, M, BD, B, D, X.  
 Dianil Fast Brown B.  
 Dianil Copper Brown O, Dianil Japonine G.  
 Dianil Green G pat.  
 Dianil Darkblue 3R pat.  
 Dianil Black G, R, AC, CB, E, T, RN extra, HW, pat.  
 Dianil New Black LBI pat.  
 Dianil Indigo O patented (can be used for loose material without  
 any addition of soda).

### 3. Cotton Colours dyed in an alkali bath.

The following colours require for dark shades large amounts of alkali together with the usual addition of salt.

The bath is prepared with common salt as stated under No. 1, and 2 to 5% soda or 2 to 5% caustic soda 76.<sup>60</sup> Tw.

Dianil Darkblue R pat.  
 Dianilblack CR, N, pat.

The following colours may be dyed with alkali without adding salt.

The bath is prepared with the necessary amounts of dyestuff and  $\frac{1}{2}$  to 5% soda or caustic soda 76.<sup>60</sup> Tw.

Dianil Red R, 4B, 10B.  
 Brilliant Dianil Red R, R conc., Delta Purpurine 5B.  
 Dianil Black PR, PG.

To be dyed with 10% Phosphate of soda and 2% soap:

Cresotine Yellow G.

N.B. for No. 1 to 3.

In dyeing mercerised material it is advisable to add to the bath — together with the stated amounts of alkali — for light shades 2% Turkey red oil and 2½% sodium phosphate, for medium shades 2 to 10% Turkey red oil and 10 to 25% Glauber's salt cryst, and for dark shades 1% Turkey red oil and 25 to 40% Glauber's salt cryst.

### 4. Cotton Colours developed with Azophor Red.

After rinsing the dyed material is worked for  $\frac{1}{2}$  h in a cold bath containing 2–4% Azophor Red PN pat. and 1–2% acetate

of soda, then the material is rinsed again and eventually soaped. Azophor Orange MN pat. and the diazo-solutions of Benzidine and Paranitraniline are applied in a similar manner.

Primuline O.

Dianil Orange N, Toluylene Orange R.

Dianil Brown 5G, 3GO, 2G, G, R, 3R, M, BD, B, D, X.

Dianil Copper Brown, Dianil Japonine G.

Dianil Dark Blue R, 3R pat., Dianil Indigo O pat.

Dianil Black G, R, CR, N, AC, CB, E, T, PR, PG, RN extra,  
HW pat.

Dianil New Black LBI pat.

#### 4a. Cotton Dyestuffs suitable for shading-off Azophor Red-developed colours.

The following colours which change only slightly when treated with Azophor Red PN pat. or Azophor Orange MN pat. are suitable for shading-off the colours given under No. 4.

Dianil Yellow R, 2R, 3G pat.

Dianil Direct Yellow S.

Aurophenine O.

Oxydianil Yellow O.

Dianil Orange G, F pat.

Dianil Green G pat.

Dianil Blue pat., all brands.

Dianil Claret Red G, B, Dianil Magenta O.

Dianil Fast Brown B.

#### 5. Cotton Colours suitable for diazotising.

After rinsing the dyed material is treated for  $\frac{1}{2}$  h in the cold diazotising bath which is prepared for light shades with:  $1\frac{1}{2}\%$  Nitrite and  $5\%$  Muriatic acid, for dark shades with:  $2\frac{1}{2}\%$  Nitrite and  $7\frac{1}{2}\%$  Muriatic acid. After diazotising the material is rinsed and entered into the developing bath in which it is worked cold for  $\frac{1}{2}$  h, then rinsed again, and finally soaped. The developing bath contains

for light to medium shades:

0,3% Phenol, 0,9% Caustic Soda  $36^\circ$  Tw.,  
0,3% Oxyphenol, 1,2% Caustic Soda  $36^\circ$  Tw.,  
0,5%  $\beta$ -Naphthol, 1% Caustic Soda  $36^\circ$  Tw.,  
0,5% Schaeffer's salt, 0,3% Soda calc.,  
0,35% m-Phenylene Diamine,  
0,35% m-Toluylene Diamine,

for medium to dark shades:

0,6% Phenol, 1,8% Caustic Soda 36° Tw.,  
 0,6% Oxyphenol, 2,4% Caustic Soda 36° Tw.,  
 1%  $\beta$ -Naphthol, 2% Caustic Soda 36° Tw.,  
 1% Schaeffer's salt, 0,6% Soda calc.,  
 0,7% m-Phenylene Diamine,  
 0,7% m-Toluylene Diamine.

Primuline O.

Dianil Brown R, G, BD, M, B, D.

Dianil Dark Blue R, 3R pat.

Dianil Indigo O pat.

Dianil Black G, R, CR, N, AC, CB, E, T, pat.

Dianil New Black LBI pat.

## 5a. Cotton Dyestuffs suitable for shading-off diazotised shades.

The following cotton colours do not change in diazotising and developing and are therefore suitable for shading-off the colours given under No. 5.

Dianil Yellow R, 2R, 3G, pat.

Dianil Direct Yellow S.

Oxydianil Yellow O.

Aurophenine O.

Dianil Orange G, F, pat.

Dianil Red R, 4B, 10B.

Dianil Claret Red G, B.

Dianil Blue pat., all brands.

Dianil Fast Brown B.

## 6. Cotton Colours suitable for an after-treatment with copper sulphate.

The dyed and rinsed material is treated in a fresh bath containing 3 to 5% copper sulphate and  $1\frac{1}{2}$  to 2% acetic acid at 140 to 212° F for  $\frac{1}{2}$  h, and then rinsed. The copper sulphate bath may contain some basic dyestuffs for shading purposes; in this case the temperature is raised gradually after working for  $\frac{1}{4}$  h cold.

Dianil Yellow R, 2R, 3G pat.

Cresotine Yellow G.

Dianil Orange G, F, R, pat., N.

Dianil Brown 5G, 3GO, 2G, 3R.

Dianil Fast Brown B.

Dianil Copper Brown O, Dianil Japonine G.

Dianil Blue pat., all brands.

Dianil Dark Blue R, 3R pat.

Dianil Black G, R, CR, N, AC, CB, E, T, RN extra, HW pat.

Dianil New Black LBI pat.



## 7. Cotton Colours suitable for chroming after dyeing.

The dyed and rinsed material is worked at 140 to 212° F for  $\frac{1}{2}$  h, in a bath containing:

3 to 4% Chloride of Chrome 32° Tw. or

3 to 4% Fluoride of Chrome and  $1\frac{1}{2}$ % Acetic acid or

4 to 5% Chrome alum

and finally rinsed.

**Dianil Yellow** 3 G pat.

**Cresotine Yellow** G.

**Dianil Orange** N.

**Dianil Brown** 5 G, 3 GO, 2 G, **Dianil Fast Brown** B.

**Dianil Copper Brown** O.

**Dianil Japonine** G.

**Dianil Green** G pat.

**Dianil Blue** pat, all brands.

**Dianil Darkblue** R, 3 R pat.

**Dianil Black** G, R, CR, N, AC, CB, RN extra, pat.

**Dianil New Black** LBI pat.

## 7a. Dyestuffs suitable for shading-off chromed colours.

The following cotton colours are not noticeably changed when after-treated with chloride of chrome, chrome alum, or fluoride of chrome.

**Dianil Yellow** R, 2 R pat.

**Dianil Direct Yellow** S.

**Oxydianil Yellow** O.

**Dianil Orange** G, F, R pat.

**Dianil Brown** G, R, 3 R, M, BD, B, D.

## 8. Direct Cotton Colours suitable for the chrome and copper after-treatment.

The dyed and rinsed material is worked in a fresh bath containing:

$1\frac{1}{2}$  to 2% Bichrome

2 to 3% Copper sulphate and

2% Acetic acid

at 140 to 212° F for  $\frac{1}{2}$  h and then rinsed.

**Dianil Yellow** 3 G pat., **Cresotine Yellow** G, **Dianil Orange** N.

**Dianil Brown** 3 GO, 2 G, **Dianil Japonine** G, **Dianil Fast Brown** B.

**Dianil Black** G, R, CR, N, T, AC, CB, pat.

**Dianil New Black** LBI.

**8a. Direct Cotton Colours** which when developed with bichrome, copper sulphate, and sulphuric acid, produce exceptionally fast shades.

The dyed material is worked in a bath containing:

2% Bichrome

3% Copper sulphate and

2% Sulphuric acid 168<sup>1</sup>/<sub>2</sub>° Tw.

for <sup>1</sup>/<sub>2</sub> h at 140 to 212° F, then thoroughly rinsed and eventually soaped.

Cresotine Yellow G.

Dianil Brown 3GO, Dianil Fast Brown B.

Dianil Japonine G.

Dianil Black N pat.

Dianil Yellow 3G (up to 1% for shading-off).

Dianil Black CR, R pat. (for Black).

} for  
Brown

## 8b. Colours suitable as a bottom under Aniline Black.

The material is first dyed with 2 to 4% dyestuff, then topped in a fresh bath containing (for 100 lbs of material):

150 to 200 Gall. Water

2 to 3 lbs 9 oz Aniline salt

2 lbs 5<sup>1</sup>/<sub>2</sub> oz Sulphuric acid 168<sup>1</sup>/<sub>2</sub>° Tw.

1<sup>1</sup>/<sub>2</sub> lbs Copper sulphate

5 lbs Bichrome.

The material is entered into the cold bath and worked for <sup>1</sup>/<sub>2</sub> h, while at the same time the bichrome solution is added in several portions. Then the temperature is raised to 131° F during <sup>1</sup>/<sub>2</sub> h, and the material worked for another <sup>1</sup>/<sub>2</sub> h. Finally the goods are rinsed and soaped in a hot soap bath; to the latter 1 lb logwood extract may eventually be added to embellish the shade.

Dianil Black CR, R, AC, CB, G, N pat.

Dianil New Black LBI pat.

Dianil Dark Blue R pat.

Melanogen Blue B pat.

Melanogen G, T, pat.

## 9. Cotton Colours suitable for dyeing in a mechanical dyeing apparatus.

Dianil Yellow 2R, 3G pat., Cresotine Yellow G.

Dianil Direct Yellow S, Aurophenine O.

Primuline O.

Dianil Orange G pat., N, Toluylene Orange R.

Dianil Claret Red B, G.

Dianil Red R, 4B, 10B.  
 Brilliant Dianil Red R, R conc., Delta Purpurine 5B.  
 Dianil Scarlet G, 2R, pat.  
 Dianil Brown 3GO, R, BD, Dianil Japonine G, Dianil Fast  
 Brown B.  
 Dianil Green G pat.  
 Dianil Blue pat., all brands.  
 Dianil Darkblue R, 3R pat., Dianil Indigo O pat.  
 Dianil Black G, R, CR, AC, CB, RN extra pat.  
 Dianil New Black LBI pat.

## 10. Cotton Colours suitable for padding in a two-roller-padding-machine.

The padding liquids are made up as follows:

|                  |        | for light, | medium,   | dark shades |
|------------------|--------|------------|-----------|-------------|
| Dyestuff         | about  | 10 parts   | 100 parts | 500 parts   |
| Turkey red oil   | 2000   | „          | —         | „           |
| Sodium phosphate | 250    | „          | 500       | 500         |
| Dextrine         | 1500   | „          | 1500      | 1500        |
| Water            | 92600  | „          | 97900     | 97500       |
|                  | 100000 | „          | 100000    | 100000      |

Light shades are padded twice at 104 to 122° F,

Dark „ „ „ „ „ 158 to 176° F,

and then dried.

Dianil Yellow 2R, 3G pat., Dianil Direct Yellow S.  
 Auropheanine O, Cresotine Yellow G.  
 Oxydianil Yellow O.  
 Dianil Orange G pat., N, Toluylene Orange R.  
 Dianil Red R, 4B, 10B.  
 Brilliant Dianil Red R, R conc., Delta Purpurine 5B.  
 Dianil Brown 3GO, R, G, BD, M, B, D, Dianil Fast Brown B.  
 Dianil Japonine G.  
 Dianil Green G pat.  
 Dianil Blue pat., all brands.  
 Dianil Dark Blue R, 3R, pat.  
 Dianil Black PR, CR, R, pat.

## 11. Cotton Colours for tannin-antimony-mordants.

(Basic Colours).

The cotton yarn is mordanted in a concentrated bath (containing about the 10 fold amount of water) with 1 to 6% tannin, according to the depth of the required shade; the yarn is entered at 122° F, worked without steam for  $\frac{1}{2}$  h, and then left in the bath steeped for 6 to 12 h or preferably over night. After wringing and hydroextracting the yarn is entered into the fixing bath con-

taining  $\frac{1}{2}$  to 3% tartar emetic and 2 to 10% chalk, and worked at 68 to 77° F for  $\frac{1}{2}$  to  $\frac{3}{4}$  h. Then the yarn is rinsed, eventually slightly soaped, and finally hydroextracted.

Old tannin baths can be used again when replenished with about 70% of the amount of tannin used for the first bath. In order to prevent decomposition, it is advisable to boil the baths repeatedly, or to add a little carbolic acid.

In many instances, especially for dark shades, the tannin can be replaced by cheaper products: 1 lb tannin equals about 1 $\frac{1}{2}$  to 2 lbs. gall nuts, or 4 lbs. sumach extract 25%, or 5 to 6 lbs. sumach leaves.

Instead of tartar emetic, other antimony salts in equivalent proportions can be employed.

Piece goods are either mordanted and fixed on the Jigger or padded in the two-roller-padding machine. In the latter case the padding liquids are made up with 2 to 50 parts tannin and 1 to 25 parts tartar emetic per 1000 parts liquid.

**Dyeing.** The hydroextracted material is entered into a cold bath containing 1 to 5% acetic acid or 2 to 10% alum; it is well worked for some time and then the dyestuff-solutions are added in several portions. After  $\frac{1}{2}$  h the bath is slowly heated to 158° F, and the material dyed to pattern, whilst the temperature is generally raised to the boil.

Finally the cotton is rinsed, eventually soaped, hydroextracted, and dried.

**Auramine** conc., O, I, II.

**Phosphine**, all brands.

**Azo Phosphine** GO, BRO, pat.

**Chrysoidine** A cryst., C cryst., C extra cryst., R, **Vesuvine**, all brands, **Cutch Brown** D, G, **Dark Brown** M, MB.

**Magenta**, all brands, **Cerise**, all brands, **Grenadine**, all brands.

**Maroon** O, extra, **Cardinal** R, G.

**New Magenta** O pat.

**Safranine** GGS, AN extra, O, conc., conc. B, **Methylene Violet**, all brands, **Methylene Heliotrope** O pat.

**Rosolane** pat., all brands.

**Scarlet for Cotton** O.

**Methyl Violet**, all brands, **Violet crystals** O.

**Victoria Blue** B.

**Malachite Green**, all brands, **Brilliant Green**, all brands.

**Rosazeine** O, B, extra, B extra, G extra, 4 G.

**Methylene Green**, all brands.

**Methylene Indigo** O, SS, **Thionine Blue** GO, **Methylene Blue**, all brands, **Marine Blue**, all brands, **Methylene Dark-blue** RBN, 3BN.

**Fastblue for Cotton**, all brands, **New Fastblue** 3R cryst.

**Indamine Blue**, all brands. **Ethyl Blue** BF, BD, RD pat.

**Indophene Blue** B, G, 2B, pat.

**Methylene Grey**, all brands, **New Methylene Grey** O, **Nigrisine** O.

**Janus Blue** G, B, R, pat., **Janus Darkblue** R, B, pat.

**Janus Green** B, G pat.

**Janus Black** O, I, II, pat., **Janus Grey** B, BB.

**Janus Brown** B, R, pat.

|                                |            |
|--------------------------------|------------|
| Janus Red B pat.               |            |
| Janus Yellow R, G, pat.        |            |
| Conc. Cotton Blue, all brands. | } see also |
| Pure Blue, all brands.         |            |
| Chinablue, all brands.         |            |
| Cotton Blue extra, OO.         |            |
| Cotton Lightblue O, soluble.   |            |
| Methyl Blue for Cotton MLB.    | § 14.      |

## 11a. Basic Colours which are dyed in one bath.

(Method protected by letter's patent.)

The cold bath is prepared with 5 to 6% acetic acid, then 1 to 2% tannin, and finally the necessary amounts of dyestuff (up to 1%) are added. The cotton is entered and worked for  $\frac{1}{4}$  h cold, then for  $\frac{1}{4}$  h at 104° F and for another  $\frac{1}{4}$  h at 140° F. Then it is lifted, rinsed, wrung out, and dried. The fastness is increased if the yarn is wrung after dyeing and treated in the first rinsing bath with  $\frac{1}{2}$  to 1 $\frac{1}{2}$ % tartar emetic. After giving some turns in this bath the yarn is rinsed a second time. Shading-off can be executed in the tartar emetic bath.

Auramine conc., O, I, II.

Phosphine, all brands.

Azo Phosphine GO, BRO, pat.

Chrysoidine A cryst., C cryst., C extra cryst., R, Vesuvine, all brands, Cutch Brown D, G, Dark Brown M, MB.

Magenta, all brands, Cerise, all brands, Grenadine, all brands.

Maroon O, extra, Cardinal R, G.

New Magenta O pat.

Safranine GGS, AN extra, O, conc., conc. B, Methylene Violet, all brands. Methylene Heliotrope O pat.

Rosolane pat., all brands.

Scarlet for Cotton O.

Methyl Violet, all brands, Violet crystals O.

Victoria Blue B.

Malachite Green, all brands, Brilliant Green, all brands.

Rosazeine, all brands.

Methylene Green, all brands.

Methylene Indigo O, SS, Thionine Blue GO, Methylene Blue, all brands, Marine Blue, all brands, Methylene Dark-blue RBN, 3BN.

Fastblue for Cotton, all brands, New Fastblue 3R cryst.

Indamine Blue, all brands, Ethyl Blue BF, BD, RD, pat.

Indophene Blue B, G, 2B, pat.

Methylene Grey, all brands, New Methylene Grey O, Nigrisine O.

Janus Blue G, B, R, pat., Janus Darkblue R, B, pat.

Janus Green B, G, pat.

Janus Black O, I, II, pat., Janus Grey B, BB.

Janus Brown B, R pat.

Janus Red B, pat.

Janus Yellow R, G, pat.

## 12. Cotton Colours dyed in a diluted acid bath.

All colours mentioned below dye unmordanted cotton material with the addition of acid salts e. g. alum, acetate of zinc, fluoride of chrome, or diluted acids.

Janus Yellow G, R, pat.

Janus Red B pat.

Janus Brown R, B, pat.

Janus Black O, I, II, pat.

Janus Green G, B, pat.

Janus Grey B, BB.

Janus Darkblue B, R, pat.

Janus Blue B, G, R pat.

Nigrisine O, Methylene Grey, all brands, New Methylene Grey O powder.

Indamine Blue N extra.

Victoria Blue B.

Safranine for light shades.

## 13. Direct dyeing Basic Colours.

(Method of dyeing protected by letter's patent.)

### Method A.

I. Dyeing. The dyebath is acidified with a little acetic acid, then 5% sulphate of zinc and a portion of the dyestuff- solution are added. The previously boiled (cotton) material is entered at about 194° F, some turns are given and then the remainder of the dyestuff-solution is added in several portions. After  $\frac{1}{2}$  h, 20% common salt or calc. Glauber's salt are added, and the material worked for  $\frac{1}{2}$  h near the boil, then the steam turned off and the goods left in the bath for another  $\frac{1}{2}$  h. Finally the material is rinsed, wrung or hydroextracted.

II. Fixing. The dyed cotton is taken into a cold bath containing 2 to 6% tannin or the equivalent amount of sumach leaves or sumach extract. After working cold for  $\frac{1}{4}$  h, the cotton is lifted, 1 to 3% tartar emetic and 1,5 to 1,6% conc. sulphuric acid are added to the bath, the material is re-entered and worked cold for  $\frac{1}{4}$  h, then for  $\frac{1}{4}$  h at 122° F, and for another  $\frac{1}{4}$  h at about 176° to 212° F. Finally the material is thoroughly rinsed.

### Method B.

I. The Dyeing process remains the same as described under method A.

II. Fixing. 1. Bath: The dyed, rinsed, and hydroextracted cotton is worked for  $\frac{1}{4}$  h at 122° F in a concentrated bath containing 2 to 6% tannin or the equivalent amount of other tannin products, and then left steeped for several hours or over night in the bath. It is then wrung or hydroextracted.

2. Bath: The tanned material is worked for  $\frac{1}{2}$  to  $\frac{3}{4}$  h in a cold fresh bath containing 1 to 3% tartar emetic, then well rinsed, eventually soaped and dried.

**Janus Yellow G, R, pat.**

**Janus Red B pat.**

**Janus Brown R, B, pat.**

**Janus Grey B, BB.**

**Janus Green G, B, pat.**

**Janus Blue G, R, B, pat., Janus Darkblue B, R, pat.**

**Janus Black O, I, II, pat.**

**Victoria Blue B.**

For shading-off purposes the following colours are suitable when used in small amounts:

**Methylene Blue, all brands.**

**Malachite Green, all brands.**

**Brilliant Green, all brands.**

**Safranine, all brands.**

**Methylene Violet, all brands.**

**Methylene Heliotrope O pat.**

**Rosolane pat., all brands.**

## 14. Cotton Colours dyeing upon tin-or tin and tannin mordant.

The well boiled and bleached cotton is entered into a cold bath containing 0.1% to 1% tin salt (and a little muriatic acid to keep the bath clear). The material is worked for  $\frac{1}{2}$  h, lifted, rinsed, and dyed cold with the necessary amounts of dyestuff and the addition of 1 to 2% acetic acid. The material is not rinsed after dyeing but at once wrung out and dried. For deep shades the material is at first mordanted with 2 to 3% tannin and then with tin mordant as described above, then rinsed and dyed in the same manner. For full shades 2 to 3% alum are added to the bath (in addition to the acetic acid), and the temperature raised to about 104° F. Shading-off with Methylene Blue, Malachite Green, Methyl Violet etc. can be executed in the same bath.

**Conc. Cotton Blue RR, R, No. 1, No. 2, No. 2 double.**

**Cotton Lightblue O soluble.**

**Cotton Blue extra OO.**

**Methyl Blue for Cotton MLB.**

**China Blue No. 1, No. 2.**

## 15. Cotton Colours dyed with alum and common salt.

The cotton is dyed in a concentrated bath containing 10% alum and 40% common salt at 104 to 122° F. The material is not

rinsed after dyeing, but wrung and then dried. Old baths can be used if properly replenished.

**Brilliant Orange G.**

**Brilliant Croceïne R, B, 5B,** blue shade, yellow shade.

## 16. Cotton Colours dyed in strong salt baths.

The dyebath is prepared with 30 to 60 parts common salt per 1000 parts liquid and the necessary amounts of dyestuff, and the cotton worked at 86° F for  $\frac{1}{2}$  to  $\frac{3}{4}$  h. After dyeing the cotton is wrung out and dried. Old baths are replenished and used again.

**Eosine,** all brands.

**Erythrosine,** all brands.

**Phloxine,** all brands.

**Rose Bengale,** all brands.

When after-treated with Solidogen A pat. the shades become fast to water (see § 18).

## 17. Cotton Colours dyeing upon oil-mordant.

The material is saturated with a solution of 100 parts Turkey red oil per 1000 parts water and dried for 12 h at 122° F. Then the cotton is dyed with the necessary amounts of dyestuff (cold to 122° F), eventually slightly rinsed or dried directly after dyeing.

All **Rosazeïnes**; for shading off purposes also **Auramines** and **Safranines**.

## 18. Cotton Colours which may be developed with Solidogen.

(Method protected by letter's patent).

### I. Dianil Colours.

The developing bath is prepared with 2% muriatic acid, then 2 to 6% Solidogen A pat. are added. The dyed and rinsed material is entered and worked at the boil for  $\frac{1}{2}$  h and then thoroughly rinsed.

### II. Eosine etc.

The developing bath is prepared as described under I, but an addition of 50 to 70 parts common salt per 1000 parts liquid is required, and the bath heated to 167° F only.

If copper vessels are used 5 to 10 parts sulphocyanide of ammonia must be added to the bath before the other ingredients are added.



Dianil Orange G pat.  
 Dianil Scarlet G, 2R, pat.  
 Dianil Red R, 4B, 10B, Dianil Claret B, G.  
 Brilliant Dianil Red R, R conc., Delta Purpurine 5B.  
 Dianil Blue G, B, R, 2R, 3R, 4R, BX, pat.  
 Dianil Black CR, R, G, AC, CB, pat.  
 Dianil New Black LBI pat.  
 Dianil Indigo O, Dianil Darkblue R pat.  
 Primuline Red (Primuline O with  $\beta$ -Naphthol).  
 Eosine, all brands, Erythrosine, all brands, Phloxine, all brands,  
 Rose Bengale, all brands.

## 19. Cotton Colours dyeing upon alumina mordant.

Alizarine Orange.  
 Alizarine Red, all brands.  
 Alizarine Claret R paste.  
 Alizarine Brown, all brands.  
 Ceruleine conc., S, S conc., paste A, paste SW.  
 Alizarine S pat.

### Turkey Red upon cotton yarn.

#### a) Alizarine New Red No. 1 (dry mordant).

1. Boiling. The raw material is boiled with 3% calc. soda or silicate of soda 76.8° Tw and then washed. Big lots are best boiled in a closed vessel for 2 hours under pressure of 2 atm.

2. Oiling. After hydroextracting, the moist yarn is passed through a solution of 120 to 150 parts Turkey red oil 50% per 1000 parts liquid and then dried at 149° F for 12 h. This operation is eventually repeated. If dried yarns are manipulated, one passage through the oil-solution is sufficient.

3. Mordanting. 4000 parts sulphate of alumina (free from iron) are dissolved in 16000 parts water; and after cooling 450 parts calc. soda dissolved in 4000 parts water, and 100 parts chalk, made into a paste with water, are added; when the carbonic acid reaction has ceased, an addition of 300 parts acetic acid 50% is made; before use this concentrated mordant is diluted with water to 12° Tw. The oiled yarn is passed dry through the mordant at 86° F, then left to lie in a cistern for 3 h, and finally hydroextracted and dried below 104° F.

Instead of the above mordant, another one, made of commercial basic-alumina-carbonate and alumina acetate, is used. (This mordant is especially often employed in piece dyeing.) The yarn is mordanted with alumina acetate 7.2° Tw and the manipulations carried out as described above.

## Acetate of alumina

is made as follows:

- 9000 parts Sulphate of alumina (purest quality) are dissolved in
  - 64350 parts Water, free from iron; after dissolving,
  - 2850 parts Sulphuric acid  $168\frac{1}{2}^{\circ}$  Tw and
  - 17400 parts Acetic acid 40% are added. The mixture is well stirred and then
  - 8900 parts Basic-alumina-carbonate are added in several portions at  $95$  to  $104^{\circ}$  F; the latter dissolves readily under effervescence.
- 102500 parts.

The solution is allowed to stand for a short time and then drawn off leaving a minute residue.

100000 parts „very stable“ acetate of alumina  $23.2^{\circ}$  Tw „free from iron“ are thus obtained which is diluted to 7 to  $9^{\circ}$  Tw.

4. Fixing. Per 1000 parts fixing liquid 5 parts chalk or 5 parts sodium phosphate are required. The dried, mordanted yarn is worked at  $122^{\circ}$  F for  $\frac{1}{2}$  h in this liquid and then thoroughly washed.

5. Dyeing. 8% Alizarine 20% are generally used. By combining Alizarine No. 1 (blue shade) and Alizarine 5F (yellow shade) all current shades of Turkey Red are obtained. For water of  $7\frac{1}{2}$  degrees an addition of 10% acetate of lime  $28.5^{\circ}$  Tw and 1% tannin (both referring to the amount of Alizarine used) is made. The yarn is dyed cold for  $\frac{1}{4}$  h, the bath heated during 1 h to  $194^{\circ}$  F, and the dyeing operation continued at this temperature for another  $\frac{1}{2}$  h. Then the yarn is quickly rinsed, hydroextracted and dried. The addition of 2% Turkey Red Oil (50%) (referring to the weight of the yarn) to the dyebath increases the brilliancy of the shade considerably.

6. Steaming. The yarn is steamed for 2 h under pressure of  $1\frac{1}{2}$  atm. If the yarn, after dyeing and hydroextracting, is put wet into the steaming apparatus, uneven results are often obtained, especially in manipulating big lots.

7. Soaping. The dyed yarn is soaped at  $140^{\circ}$  F; 2 parts soap per 1000 parts liquid being used. In order to obtain a purer red the yarn is boiled in a closed vessel for 1 h. — After washing the yarn is dried at a low temperature. To obtain a Red of greater brilliancy and fastness, the yarn is boiled in a closed vessel for 2 h under pressure of 2 atm. with 2 parts soap, 0,3 parts solvay soda and 0,1 part tin salt per 1000 parts water.

**Alizarine New Pink.** For pinks, bleached yarns are used which are oiled twice, the first time with 40 parts and the second time with 20 parts Turkey red oil 50% per 1000 parts liquid. After each oiling-operation the yarn is dried. Then the yarn is mordanted with acetate of alumina  $4^{\circ}$  Tw for pink, dried at  $104^{\circ}$  F. and fixed as described under „Red“, then dyed cold for  $\frac{1}{2}$  h with  $\frac{1}{2}$  to 3% Alizarine blueish and 0,1 to 0,3% acetate of lime  $29^{\circ}$  Tw, and for another h. at  $167^{\circ}$  F. After rinsing the yarn is steamed for 2 h under pressure of  $1\frac{1}{2}$  atmospheres and finally soaped (with 2 parts soap per 1000 parts) at  $140^{\circ}$  F for  $\frac{1}{2}$  h.

## Acetate of Alumina for Pink.

- I. { 6 parts of Alum free from iron, dissolved in  
20 parts hot Water
- II. {  $4\frac{1}{2}$  parts of Sugar of lead diss. in  
10 parts of hot Water.

Solutions I and II are mixed hot; after allowing the preprecipitate to settle the clear solution is drawn off and, before use, made to twaddle at  $4.4^{\circ}$ .

**Alizarine Claret Red** is dyed upon New Red bottom with Alizarine Claret R, alone or in combination with a blue shade of Alizarine Red. By using some Alizarine Brown very dark Claret Reds can be obtained.

The manipulations of mordanting, dyeing etc. are the same as described under Aliz. Red.

## b) Alizarine New Red No. 2 (wet mordant).

1. Boiling. The raw yarn is boiled with 3% calc. soda and then washed.

2. Oiling. The moist, hydroextracted yarn is oiled in a solution of 120 to 150 parts Turkey red oil 50% per 1000 parts liquid which is made to twaddle at  $8^{\circ}$  Tw by the addition of a solution of potash. This operation is eventually repeated and then the oiled yarn dried at  $149^{\circ}$  F within 12 h.

3. Mordanting. 3000 parts of sulphate of alumina, free from iron, are dissolved in 12000 parts of water; when cold 320 parts calc. soda dissolved in 3000 parts of water, are added. The concentrated mordant is diluted with water to  $7.2^{\circ}$  Tw and the dry, oiled yarn passed through it; then the yarn is left to lie in a vat for 24 h, and afterwards hydroextracted and fixed.

4. Fixing. For 1000 parts fixing liquid 15 parts chalk or 15 parts sodium phosphate are required. The hydroextracted and mordanted yarn is worked at  $122^{\circ}$  F for  $\frac{1}{2}$  h and then well washed.

5. Dyeing. 8% Alizarine 20% are generally used for dyeing. For water of  $7\frac{1}{2}$  degrees of hardness an addition of 10% acetate of lime  $29^{\circ}$  Tw and 1% tannin (calculated upon the amount of Alizarine used) is made. The dyeing operation is started cold, after  $\frac{1}{4}$  h the bath is slowly (within  $\frac{1}{2}$  h) heated to the boil and boiling continued for another  $\frac{1}{2}$  h.

6. Softening. The dyed yarn is washed, hydroextracted and boiled in a closed vessel under pressure of 2 to 3 atm. for 2 h.

7. Soaping. After softening, the shade is embellished by boiling the material for 1 h under pressure of 1 atm. with soap (2 parts p. 1000). Then the yarn is washed and finally dried at a low temperature.

### c) Mixed Alizarine Old Red.

1. Boiling. The yarn is first boiled with 3% of soda calc. and washed.

2. First Oiling. The moist, hydroextracted yarn is oiled with Tournant oil (100 parts per 1000). This solution is made up to 9° Tw with a solution of potash. After passing through this liquid the yarn is left to lie for 24 h and then dried within 12 h at 149° F.

3. Second Oiling. After drying, the yarn is oiled a second time with 40 parts of Tournant oil and 80 parts of Turkey red oil 50% per 1000 parts of liquid. The latter is made up with a solution of potash to 6° Tw. After hanging the oiled yarn in the open air for 4 h it is dried within 12 h at 149° F.

4. Third Oiling. The second oiling liquid is diluted with water and a potash solution to 5° Tw; the yarn is then passed through; again hung in the open air for 4 h, and finally again dried within 12 h at 149° F.

5. First Soaking. The dried material is soaked in a solution of potash of 1° Tw for 3 h at 86° F, then hydroextracted and dried at 149° F.

6. Second Soaking. The dried yarn is steeped in warm water of 86° F for 3 h, then washed and hydroextracted.

7. Sumaching. For every lb of yarn 3 to 4 oz of sumach leaves are required. The yarn is steeped in the sumach decoction (104° F) and after 6 h hydroextracted and then mordanted.

8. Mordanting. 4000 parts of alumina sulphate (free from iron) are dissolved in 16000 parts of hot water, and when cold a solution of 400 parts of soda calc. in 4000 parts of water is added. This mordant is made to twaddle at 7.2° Tw by diluting with water, then the yarn is passed through and left to lie for 24 h. Finally it is well washed.

9. Dyeing. Usually 9% Alizarine paste 20% are required for dyeing. For reds, which are perfectly fast to bleaching, Alizarine Red No. 1 is used. The mordanted yarn is dyed  $\frac{1}{4}$  h cold, then the dyeliquid heated to the boil within  $1\frac{1}{2}$  h and boiling continued for  $\frac{1}{2}$  h.

10. Softening. 100 lbs of yarn (for yellow shade) are softened with 1 lb soda calc. 1 lb soap, and 3 to 4 oz tin-salt. For a blue shade only soap and soda are used. The dyed and washed material is then boiled for 6 h under pressure of 2 atm. and washed again. Reds fast to rubbing are produced by repeating this operation. Then the yarn is washed and dried at a low temperature.

For **Old Pink** the oil bottom remains unaltered, only the strength of the mordant is reduced to 4° Tw. In all other respects the manipulation remains the same as with Old Red; the yarn, however, is often softened twice, at first with soda and then with soap and soda.

Old Claret Red is manipulated in the same manner as Old Red, blue shade; for dyeing, however, Alizarine Claret R is used.

#### d) Sulphite Alizarine Red.

A simpler method of dyeing Alizarine Colours with sulphite salts for the production of Turkey Reds has been protected by Royal letters patent D.R.P. 128997. This method offers the advantage of yielding shades, which are distinguished for their greater fastness to rubbing. This process is especially applicable to bottoming mixed Reds and is also very suitable for the ordinary Turkey Red oil mordant, if the yarn is steamed directly after oiling.

##### I. Sulphite Red on mixed Red mordant.

1. First Oiling. The moist (boiled and hydroextracted) yarn is oiled in a solution of 100 parts Turkey Red Oil 60% per 1000 parts of liquid, and then dried for 12 h at 60° C.

2. Second Oiling. The dried, oiled yarn is passed through a solution of 150 parts Tournant Oil in 1000 parts of liquid. This solution is made up with potash to 9° Tw. The yarn is then dried for 12 h at 140° F.

3. First Soaking. The dried yarn is steeped for 3 h in a solution of potash of 9° Tw at 86° F, then hydroextracted and dried at 140° F.

4. Second Soaking. The yarn is steeped for 3 h in warm water of 86° F; then washed and dried.

5. Third Soaking. The second soaking process is repeated, then the yarn well washed and hydroextracted.

6. Dyeing. The yarn is dyed in the 30 fold amount of water. The bath contains:

- 4200 parts Sulphate of Alumina (pure)
- 3800 parts Sodium pyrosulphite powder 95%
- 15000 parts Acetate of Lime
- 8—10000 parts Alizarine paste 20%.

The amount of acetate of lime depends upon the hardness of the water.

The yarn is dyed  $\frac{1}{3}$  h cold, the temperature raised to the boil within 1 h; the yarn then worked  $\frac{1}{2}$  h at the boil, and finally rinsed and dried.

7. Steaming. The yarn is steamed under pressure of 1 atm. for 1 h.

8. Soaping. The yarn is soaped for 20 min. at 176° F with 1 part of soap per 1000 parts of liquid. This process can be omitted, but it tends to make the yarn softer and the shades purer.

## II. Sulphite Red on steamed Red Oil mordant.

1. Oiling. The boiled and dried yarn is passed through a solution containing 150 parts Ammonia Turkey Red Oil 60% per 1000 parts of liquid, then wrung evenly and dried for 12 h at 140° F.

2. Steaming. The oiled and dried yarn is steamed for 1 h without pressure.

3. Dyeing. The dyeing operation, also the steaming and soaping is carried out as described above (under 6).

Good results are also obtained with this Sulphite process if the yarn is oiled twice with 100 parts of Turkey Red Oil 60% per 1000 parts of liquid, instead of oiling once and then steaming.

## Directions for producing Turkey Red on piece goods.

1. Oiling. The oil bath contains 1000 parts of Turkey red oil 50% (which is neutralized with ammonia) and 4000 parts of water (free from lime). The pieces are passed through the bath once or twice, then dried and eventually steamed for 1 h under pressure of  $\frac{1}{2}$  atmosphere.

2. Mordanting. The material is mordanted with acetate of alumina 7.2° Tw. (as described on page 37 under New Red for yarn).

3. Fixing. The fixing bath contains 10 parts of chalk or 5 parts of sodium phosphate per 1000 parts of liquid; the pieces are worked in this bath at 113° F for  $\frac{1}{2}$  h and then well washed.

4. Dyeing. The pieces are dyed cold in the 30 fold amount of water (which is corrected according to its degree of hardness) with

10% Alizarine 20%,  
1,5% Acetate of lime 29° Tw,  
0,15% Tannin

for  $\frac{1}{4}$  h; the temperature is then raised to 158° F within  $1\frac{1}{4}$  h and then the dyeing operation continued at 167° F for  $\frac{1}{2}$  h; finally the pieces are washed.

5. Oiling. The pieces are passed through a solution of 1000 parts of Turkey red oil 50% and 9000 parts of water (free from lime), then they are dried and steamed for 2 h under pressure of  $1\frac{1}{2}$  atm.

6. Soaping. Finally the pieces are worked in a bath containing 2 parts of soap per 1000 parts water at 140° F for 20 min., then washed and dried.

**Pink on piece goods** is generally produced according to the so-called Erban-Specht method (see page 47).

To produce a **Claret Red upon piece goods** the latter are mordanted in the same manner as for „Red“ and then dyed with Alizarine Claret R by itself or in combination with Alizarine Red. In order to obtain full and dark brownish claret reds with as little dyestuff as possible the addition of some Alizarine Brown is advisable.

## Table for correcting the water,

containing the requisite amounts of acetate of lime and acetic acid in dyeing Alizarine Red shades, calculated for 100 l of water according to its degree of hardness.

| Degrees of hardness |       | Acetate of lime 28° Tw | Acetic acid 12° Tw |
|---------------------|-------|------------------------|--------------------|
| 1                   | 1.25  | 65,4 cc.               |                    |
| 2                   | 2.5   | 56,3 „                 |                    |
| 3                   | 3.75  | 47,2 „                 |                    |
| 4                   | 5     | 38,1 „                 |                    |
| 5                   | 6.25  | 27,2 „                 |                    |
| 6                   | 7.5   | 20,0 „                 |                    |
| 7                   | 8.75  | 1,09 „                 | 4,5 cc.            |
| 8                   | 10    | 1,8 „                  | 9,0 „              |
| 9                   | 11.25 |                        | 13,5 „             |
| 10                  | 12.50 |                        | 18,0 „             |
| 11                  | 13.75 |                        | 22,5 „             |
| 12                  | 15    |                        | 27,0 „             |
| 13                  | 16.25 |                        | 31,5 „             |
| 14                  | 17.50 |                        | 36,0 „             |
| 15                  | 18.75 |                        | 40,5 „             |
| 16                  | 20    |                        | 45,0 „             |
| 17                  | 21.25 |                        | 49,5 „             |
| 18                  | 22.50 |                        | 54,0 „             |
| 19                  | 23.75 |                        | 59,5 „             |
| 20                  | 25    |                        | 64,0 „             |

## 20. Cotton Colours which dye upon an iron mordant.

The material is padded with 3 to 4 parts tannin per 1000 parts of liquid and then passed through a bath containing pyrolignite of iron 3° Tw; after rinsing, the cotton is dyed in the same manner as described under Turkey red. For light violets the material is at first passed through the bath which contains the pyrolignite solution of 3° Tw and then treated on the two roller padding machine with 7 to 10 parts of silicate of soda (of 53° Tw) per 1000 parts liquid at 122° F; the material is then washed and dyed.

**Alizarine Red**, all brands.

**Solid Green O** 50‰.

## 21. Cotton Colours which dye upon alumina-iron-mordant,

For claret red shades which require only little iron, the yarn is either oiled, sumached, then mordanted with basic alumina sulphate (Old Red bottom), rinsed, and finally treated with iron liquid,

or it is treated first with alumina (as for New Red), washed, and then treated cold with tannin; after raising the temperature to 122° F. the yarn is rinsed and finally passed cold through a solution of pyrolignite of iron. The application of mixtures of alumina and iron mordants is only admissible on yarns if large amounts of iron are used (for lilac shades), whilst in piece dyeing mixtures of acetate of alumina and iron may be used. In this case the method which is well known in printing, can also be employed: Before oiling, the pieces are treated on the two roller machine with the mixed mordants, then hung up for a time and fixed with silicate of soda, sodium phosphate, chalk etc., and dyed; then oiled, and finally steamed (as for Red).

For yarns a simpler method can be employed:

- I. Bath: The yarn remains, for 12 h., in a bath containing 20% sumach extract and is then hydroextracted.
- II. Bath: The yarn is steeped for 12 h. in a bath containing basic alumina sulphate of 6–8° Tw and is then rinsed.
- III. Bath: The yarn is worked, for  $\frac{1}{2}$  to  $\frac{3}{4}$  h. in a bath containing pyrolignite of iron of 1–3° Tw, then rinsed and hydroextracted.

The yarn is dyed as described under Turkey Red and oiled with 5% Red oil, then steamed under pressure of 1 to 1 $\frac{1}{2}$  atm. for 1 h. and finally soaped (2 parts soap per 1000 parts of liquid) at 140° F for  $\frac{1}{4}$  h.

**Alizarine Red**, especially the blue brands 2a bl. bl., No. 1, DBI, IBB, IB, IB new, DIB new.

**Alizarine Claret R** paste.

**Solid Green O**, 50%.

## 22. Cotton Colours which dye upon a chrome mordant.

Directions for dyeing 100 lbs of yarn.

Method A.

1. Boiling. The raw yarn is boiled with 3 lbs of soda and then washed.

2. Mordanting. The hydroextracted yarn is worked cold in Chrome Mordant GAI 19° Tw for  $\frac{1}{2}$  h. then steeped in this mordant for 12 h. and then hydroextracted. The liquid can be used again if properly replenished.

3. Fixing. The mordanted and hydroextracted yarn is fixed with 2% soda (20 parts solvay soda per 1000 parts water) at 122° F for  $\frac{3}{4}$  h. and then well washed.

4. Dyeing. The dyebath contains 15 lbs dyestuff (paste), which is previously dissolved in 6 $\frac{1}{2}$  lbs ammonia 25%, 5 Gall. water, and 2 to 3 oz. of tannin. The yarn is worked in the cold bath for  $\frac{1}{4}$  h. then 15 lbs acetic acid 12° Tw are added and the



yarn worked for another  $\frac{1}{4}$  h, then the temperature is slowly raised to the boil within 1 h and the dyeing operation continued at the boil for  $\frac{1}{2}$  h. If calcareous water is used, the carbonate of lime must be converted into acetate of lime with Acetic acid.

For Alizarine Blue, however, water which is free from lime must be employed. In this instance the dyebath contains:

15 lbs Alizarine Blue paste,  
28 $\frac{1}{2}$  lbs Acetic acid 12° Tw,  
17 lbs Ammonia 25%.

5. Soaping. The dyed and washed yarn is soaped with 5 to 10 lbs of soap at the boil for  $\frac{1}{2}$  h.

#### Method B.

1. Boiling. The raw yarn is boiled with 3 lbs soda and then washed and hydroextracted.

2. Oiling. The boiled and hydroextracted yarn is oiled with a solution of 100 parts Red oil 50% per 1000 parts liquid and then slowly dried at 149° F within 12 h.

3. Mordanting. The dried yarn is at first worked cold in Chrome Mordant GAI 19° Tw. for  $\frac{1}{2}$  h and then steeped in this mordant for 12 h; after hydroextracting the yarn is then treated as stated under Method A.

#### Method C.

(For dark shades, especially claret reds.)

The yarn which is boiled, washed and hydroextracted as described under Method A, is treated in a bath containing the 15 fold amount of water of 176° F (compared with the weight of the yarn) and 5 parts tannin or 25 parts sumach extract 20% per 1000 parts liquid; the yarn is worked at 176° F for  $\frac{1}{2}$  h, then the steam is turned off and the yarn left in the bath for about 12 h. After hydroextracting the yarn is at first worked cold in Chrome Mordant GAI 19° Tw for  $\frac{1}{2}$  h, then steeped in this mordant for 12 h, and finally hydroextracted and washed — The material is dyed and soaped as described under Method A. — The Method C permits of topping with basic colours simultaneously or afterwards.

**Alizarine Yellow** GG pat., N.

**Mordant Yellow** O.

**Alizarine Orange** N.

**Alizarine Brown**, all brands.

**Alizarine Red**, all brands.

**Alizarine Claret** paste R.

**Alizarine Blue**, all „S“ brands.

**Ceruleine** conc., S, S conc., SW paste.

**Alizarine Green** paste S pat.

**Ga'leine**, all brands.

## Directions for producing Dark Blues fast to bleaching.

1. Boiling. 100 lbs raw cotton yarn are boiled with 3 lbs solvay soda under pressure of 2 atmospheres for 3 h and then thoroughly washed.

2. Oiling. The boiled, washed and hydroextracted yarn is oiled in a solution of 90 to 120 parts Sodium-Turkey red oil 50% per 1000 parts liquid, then wrung evenly and dried at 149° F for 12 h.

3. Treatment with tannin. The oiled and dried yarn is worked in a warm tannin-solution at 176° F for  $\frac{3}{4}$  h and then steeped in this bath for 12 h and hydroextracted. The tannin-solution is made up with the 10 to 15 fold amount of water (compared with the weight of the yarn) and contains 5 parts of tannin per 1000 parts of liquid.

4. Chrome Mordant. The tanned and hydroextracted yarn is worked cold in a solution of chloride of chrome 19° Tw for 1 h and then steeped in this bath for 12 h. After hydroextracting, the yarn is washed (preferably in running water).

Both the chloride of chrome solution and the tannin mordant can be used again if properly replenished.

5. Dyeing. For dyeing, water free from lime must be employed; water of  $2\frac{1}{2}$ ° hardness is permissible, but the carbonate of lime must be converted into acetate by adding acetic acid. Very calcareous water must be freed from lime before use. The dyebath contains per 100 lbs of yarn:

|                               |                                |  |
|-------------------------------|--------------------------------|--|
| 15 lbs Alizarine Blue F paste | or                             |  |
| 28½ lbs Acetic acid 12° Tw    | 5 lbs Alizarine Blue SB Powder |  |
| 17 lbs Ammonia 25°/o          | 5 lbs Acetic acid 12° Tw       |  |
| 2½—3 oz Tannin                | 2½—3 oz Tannin.                |  |

The yarn is worked cold for  $\frac{1}{4}$  h, then the bath is slowly heated to the boil within 1 h and the yarn worked at the boil for  $\frac{3}{4}$  h. Finally it is washed and hydroextracted.

6. Steaming. The dyed and washed yarn is steamed under pressure of 1 to  $1\frac{1}{2}$  atm. for 2 h.

7. Soaping. After steaming the yarn is soaped at the boil for  $\frac{1}{2}$  h, either in an open or in a closed vessel. According to the nature of the water 2 to 5 parts soap per 1000 parts water are required.

## 22a. Colours which are soluble in bisulphite.

These colours can be used in combination with bisulphite of chrome in the padding machine (one bath process) and are fixed by steaming. Ceruleine, however, is not so easily soluble as Alizarine Blue SB and Alizarine Green S.

**Alizarine Blue SB.**

Ceruleine S paste, SW, S conc.

Alizarine Green S pat.

## 23. Cotton Colours suitable for Erban-Specht's process.

(Method protected by letter's patent.)

The Alizarine dyestuffs are dissolved in water, free from lime, by means of ammonia or Dissolving Ether MLB, then diluted and mixed with neutral Turkey red oil. The well bleached cotton is impregnated with this liquid, then dried at 122 to 140° F and passed through a second bath which contains the required mordants (acetate of alumina, chrome, iron, lime). The material is wrung evenly or passed through squeezing rollers and then either dried or in the moist state steamed for 1 to 2 h with or without pressure; finally the cotton yarn is soaped, or softened.

**Alizarine Yellow** GG pat., R, N.

**Alizarine Orange** N.

**Alizarine Red**, all brands.

**Alizarine Claret** R paste.

**Alizarine Brown**, all brands.

**Solid Green** O, 50%.

**Ceruleine** paste A.

**Alizarine Green** S pat.

### a. Pink on piece-goods and yarn.

Alizarine solution: 100 parts Alizarine, paste,  
1300 „ Water (free from lime),  
200 „ Ammonia 25%.

| I. Bath:                              | 1.         | 2.      | 3.      | 4.      | 5.         |
|---------------------------------------|------------|---------|---------|---------|------------|
| Water (free from lime)                | 1900 parts | 1885 p. | 1835 p. | 1735 p. | 1635 parts |
| Neutral - Turkey red oil 80% sol. 1:4 | 240 „      | 240 „   | 240 „   | 240 „   | 240 „      |
| Alizarine solution                    | 25 „       | 50 „    | 100 „   | 200 „   | 300 „      |

### II. Bath:

|                           |            |            |            |            |            |
|---------------------------|------------|------------|------------|------------|------------|
| Water                     | 2170 parts | 2165 parts | 2160 parts | 2150 parts | 2136 parts |
| Acetic acid 12° Tw        | 3 „        | 3 „        | 3 „        | 3 „        | 3 „        |
| Acetate of alumina 19° Tw | 2,7 „      | 5,4 „      | 10,8 „     | 21,6 „     | 32,4 „     |
| Acetate of lime 29° Tw    | 0,47 „     | 0,95 „     | 1,9 „      | 3,8 „      | 5,7 „      |

In order to obtain very blue shades of pink only one half of the given amounts of Acetic Acid and Acetate of lime (II. bath) are used.

|                             |         |                                         |
|-----------------------------|---------|-----------------------------------------|
| III. Softening: 10000 parts | Water   | } 2 hs under pressure of 2 atmospheres. |
| 5 „                         | Soda    |                                         |
| 1 „                         | Tinsalt |                                         |
| 5 „                         | Soap    |                                         |

Acetate of alumina 19° Tw.

|   |                         |
|---|-------------------------|
| { | 1908 parts Alum,        |
| { | 2000 „ Water,           |
| { | 1590 „ Acetate of lead, |
| { | 1600 „ Water,           |

are dissolved separately and then mixed. After precipitating the sulphate of lead, and cooling

150 parts Soda crystals

are added; and the whole allowed to settle for 24 h; the solution is then drawn off and made to twaddle at 19° Tw.

If acetate of iron is used as a mordant, lilac shades are obtained.

### b. Turkey red on cotton cloth.

The boiled or bleached goods are passed cold through the padding machine containing:

14 lbs  $1\frac{1}{3}$  oz Alizarine red FH paste 20%,  
 5 gall  $\frac{5}{8}$  nog. Water (free from lime),  
 3 pints Ammonia 25%,  
 1 gall Turkey red oil 80%.

After drying the pieces in the hotflue, they are passed cold through the mordant:

$4\frac{1}{2}$  gall Water,  
 $\frac{3}{4}$  gall Acetate of alumina 15° Tw,  
 3 pints Acetate of lime 29° Tw.

Then the goods are dried again and steamed: for 1 h without pressure, for  $\frac{1}{2}$  h under pressure of 1 atmosphere, and for another  $\frac{1}{2}$  h under pressure of 2 atm. The pieces are then washed and soaped at the boil for  $\frac{1}{4}$  h (2 lbs soap per 10 gall water); finally they are washed again and softened under pressure af 2 atm. for 2 to 6 h with

10 gall Water,  
 1 oz Soap,  
 1 oz Soda crystals.  
 $\frac{1}{6}$ — $\frac{1}{4}$  oz Tinsalt.

For heavier cloths (Moleskins, Flanneltes etc.) the baths are diluted with  $\frac{1}{4}$ — $\frac{1}{3}$  of their volume. Instead of Ammonia or Sodium Turkey Red Oil the Monooxy Acid of Schmitz in Heerdt or Castor Oil Soap may be employed with advantage.

Acetate of Alumina 15° Tw.

|   |                                                         |
|---|---------------------------------------------------------|
| { | $6\frac{2}{3}$ lbs Sulphate of Alumina are dissolved in |
| { | 6 lbs hot Water                                         |
| { | $9\frac{1}{2}$ lbs Sugar of Lead are dissolved in       |
| { | 9 lbs hot Water                                         |

and mixed. After letting the precipitate settle down, the solution is made to twaddle at 15° Tw before being used.

## Acetate of Lime 28.4° Tw.

|                     |                           |
|---------------------|---------------------------|
| 3 $\frac{1}{2}$ lbs | pure lime are slaked with |
| 5                   | „ Water and diluted with  |
| 15                  | „ Water, and              |
| 12                  | „ Acetic Acid of 12° Tw   |

are added, the whole left to stand for 1—2 days; then the clear alkaline solution drawn off and diluted with Acetic Acid until a slight acid reaction is noticeable. Before use the solution is made to twaddle 28.4° Tw.

## C. Fancy shades.

The yarn (which must be bleached if light shades are required) is passed through Bath I (Alizarine solution) wrung evenly, dried at 140° F and then passed into the II bath (Mordant solution). After wetting it well, it is carefully and evenly wrung and then, either dried or in its moist state, steamed for 1—2 h without or with very slight pressure. The colours are thus developed.

Piece goods are treated on the padding machine in a similar manner.

The colour solutions are made up as follows:

| for light shades                         | for dark shades                           |
|------------------------------------------|-------------------------------------------|
| 50 parts dyestuff made into a paste with | 800 parts dyestuff made into a paste with |
| 450 „ Water,                             | 7200 „ Water free from                    |
| 8750 „ Water free from lime,             | lime,                                     |
| 250 „ Ammon. 25% (1:10),                 | 300 „ Ammonia,                            |
| 500 „ Turkey Red Oil 80% (1:4).          | 400 „ Dissolving Ether                    |
|                                          | MLB,                                      |
|                                          | 400 „ Turkey Red Oil 80%.                 |
| 10000 parts.                             | 9100 parts.                               |

When using Alizarine Brown and Ceruleine it is advisable to filter the solutions. For Solid Green O less dyestuff and correspondingly more Water is required (for dark shades: 320 parts Dyestuff and 7680 Water).

The Mordant solutions are prepared as follows:

| for light shades                 | for dark shades                   |
|----------------------------------|-----------------------------------|
| Alumina mordant.                 |                                   |
| 9525 parts Water,                | 6200 parts Water,                 |
| 250 „ Acetic Acid 12° Tw (1:10), | 1400 „ Acetate of Alumina 15° Tw, |
| 175 „ Acetate of Alumina 15° Tw, | 400 „ Acetate of Lime 28.4° Tw.   |
| 50 „ Acetate of Lime 28.4° Tw.   |                                   |
| 10000 parts.                     | 8000 parts.                       |

**Chrome mordant.**

|              |                    |             |                   |
|--------------|--------------------|-------------|-------------------|
| 9638 parts   | Water,             | 7100 parts  | Water,            |
| 250 „        | Acetic acid 12° Tw | 700 „       | Acetate of chrome |
|              | 1:10,              |             | 32.4° Tw,         |
| 87 „         | Acetate of chrome  | 200 „       | Acetate of lime   |
|              | 32.4° Tw,          |             | 28.4° Tw.         |
| 25 „         | Acetate of lime    |             |                   |
|              | 28.4° Tw.          | 8000 parts. |                   |
| 10000 parts. |                    |             |                   |

**Iron mordant (for Lilac shades).**

|              |                           |
|--------------|---------------------------|
| 9475 parts   | Water,                    |
| 250 „        | Acetic acid 12° Tw 1:10,  |
| 250 „        | Acetate of iron 15° Tw,   |
| 25 „         | Acetate of lime 28.4° Tw. |
| 10000 parts. |                           |

**23a. Alizarine One Bath Colours.**

In certain cases, especially for light shades and for those colours which require no Lime, the alkaline mordants may be added to the bath (in piece dyeing) so that the goods are only passed once through the padding liquid and are then steamed. In this case the shades may be embellished with suitable wool colours and Eosines, which are fixed by means of chrome.

|             |                                                                                                           |
|-------------|-----------------------------------------------------------------------------------------------------------|
| 10 parts    | Alizarine Claret R (or 5 parts Alizarine Claret, and 1/2 part Fast Acid Violet R, B or Fast Acid Blue R), |
| 895 „       | Water,                                                                                                    |
| 50 „        | Ammonia 1:10,                                                                                             |
| 20 „        | Acetate of Soda 1:10,                                                                                     |
| 25 „        | alk. Chrome mordant.                                                                                      |
| 1000 parts. |                                                                                                           |

**Alkaline Chrome Mordant.**

|             |                                      |
|-------------|--------------------------------------|
| 200 parts   | Ammonia,                             |
| 267 „       | Water,                               |
| 133 „       | Glycerine,                           |
| 400 „       | sextuple Acetate of Chrome 32.4° Tw. |
| 1000 parts. |                                      |

Solid Green O may also be used for the one bath method, but it produces a fast brown when employed (padded and steamed) as a self colour in an ammoniacal solution.

**Directions.**

The pieces (after being boiled in Soda or bleached) are passed through the padding liquids, which must be carefully prepared (as given below) and are then dried in the hotflue. Care must be taken to avoid rust-marks (especially in light shades) as the Iron lake of Solid Green produces dark, greenish spots.

After dyeing, the pieces are steamed for 1/4—1/2 h according to the depth of the required shade, and finally washed and soaped

in the usual manner. Shades obtained with padding liquids which contain copper solutions are distinguished for their fastness to light.

### Padding liquids.

|                         |           |                                         |                         |           |                             |
|-------------------------|-----------|-----------------------------------------|-------------------------|-----------|-----------------------------|
| {                       | 120 parts | Solidgreen O are made into a paste with | {                       | 800 parts | Solidgreen O paste          |
|                         | 2000      | Water, and mixed into                   |                         | 2000      | Water                       |
|                         | 150       | Borax dissolved in                      |                         | 450       | Borax                       |
|                         | 2000      | Water                                   |                         | 2000      | Water                       |
| {                       | 50 parts  | Turkey Red Oil diss. in                 | {                       | 500       | Ammonia                     |
|                         | 2000      | Water, and                              |                         | 50        | Turkey Red Oil              |
|                         | 150       | Acetate of chrome 32.4° Tw. diss. in    |                         | 2000      | Water                       |
|                         | 2000      | Water, are added and the whole          |                         | 150       | Alkaline solution of copper |
| made up to 10000 parts. |           |                                         | made up to 10000 parts. |           |                             |
| {                       | 40 parts  | Alizarin Red No. I paste 20% and        | {                       | 120 parts | Solidgreen O paste          |
|                         | 150       | Borax diss. in                          |                         | 1000      | Water                       |
|                         | 2000      | Water                                   |                         | 150       | Borax                       |
|                         | 120       | Solidgreen O paste                      |                         | 2000      | Water                       |
| {                       | 1000      | Water                                   | {                       | 20        | Alizarine-Yellow N powder   |
|                         | 50        | Turkey Red Oil,                         |                         | 1500      | hot water                   |
|                         | 2000      | Water                                   |                         | 50        | Turkey Red Oil              |
|                         | 150       | Alkaline solution of copper             |                         | 2000      | Water                       |
| {                       | 1500      | Water                                   | {                       | 150       | Acetate of chrome 32.4° Tw. |
|                         |           |                                         |                         | 2000      | Water                       |
| made up to 10000 parts. |           |                                         | made up to 10000 parts. |           |                             |

|                         |           |                             |
|-------------------------|-----------|-----------------------------|
| {                       | 120 parts | Solidgreen O paste          |
|                         | 100       | Caustic soda 36° Tw.        |
| {                       | 2000      | Water                       |
|                         | 60        | Ceruleine conc.             |
| {                       | 200       | Caustic soda 36° Tw.        |
|                         | 2000      | hot Water                   |
| {                       | 50        | Turkey Red Oil              |
|                         | 2000      | Water                       |
| {                       | 250       | Acetate of chrome 32.4° Tw. |
|                         | 2000      | Water                       |
| {                       | 225       | Alkaline solution of copper |
|                         | 2000      | Water                       |
| made up to 10000 parts. |           |                             |

### Alkaline solution of copper.

|            |                              |
|------------|------------------------------|
| 1000 parts | Chloride of copper 76.6° Tw. |
| 500        | Tartaric acid                |
| 1200       | Caustic soda 76.6° Tw.       |
| 400        | Glycerine.                   |

## 24. Vat Colours.

### 1. Zinc dust Lime Vat.

- 11 lbs. Indigo MLB 20% paste  
 2—2½ „ Zinc dust Ia. Qual.  
 6—7 „ Quick Lime Ia. Qual.

The Indigo paste is first mixed with the Zinc, (after having stirred the latter into 2½ Gall warm Water 122° F) and then with the slaked lime. The whole is left to stand for 5—6 h, but is stirred from time to time. This standard solution is added to the vat, which is sharpened with ½ lb Zinc dust and 1 lb Lime for every 100 Gall of water, and the material dyed in this vat.

### 2. Iron sulphate Lime Vat. (Vitriol Vat.)

- 5 lbs Indigo MLB 20% paste  
 5 „ Sulphate of Iron (free from copper)  
 6 „ Quick Lime

The Sulphate of Iron is dissolved in hot water and added to the Indigo paste. Whilst continually stirring the slaked lime is added. The whole is left to stand for 5—6 h or over night, but is stirred from time to time. This standard solution is added to the vat, which is sharpened with 1 lb Sulphate of Iron and 2 lbs of lime for every 100 Gall of water, and the material dyed in this vat.

### 3. Hydrosulphite Vat.

- 5 parts Indigo MLB paste 20% are mixed with  
 3 „ hot Water, and to this mixture  
 8½ „ Soda lye 76° Tw. added,

and the whole well stirred. After heating to 113° F., 25 parts Hydrosulphite 20° Tw. (directions as below) or 8 parts Hydrosulphite MLB 32.4° Tw. are added and the temperature kept at 113° F.

In the course of the reduction which takes place and which is tested in the usual way with a sheet of glass, more Hydrosulphite solution is added in several portions. The reduced Indigo ought to run off a sheet of glass as a yellow liquid, which oxydises in 20—30 sec.

The dye-vat is sharpened with 2 lbs Hydrosulphite solution 20° Tw. for every 100 gall of water.

Instead of preparing a Hydrosulphite Vat the Indigo MLB Vat I pat. 20% can be employed with great advantage. In this case the special preparation of a standard solution is dispensed with. The vat is sharpened with 10—15 lbs Hydrosulphite 20° Tw. or 3—4 lbs Hydrosulphite MLB 32.4° Tw. for every 100 gall of water, then the Indigo MLB Vat I pat. and the necessary amount of soda lye is added, the liquid well stirred and the dyeing operation carried out as usual.

Preparing the Hydrosulphite sol. of 19—20° Tw.

100 parts Bisulphite of 71.4° Tw. are diluted with 225 parts cold water, and in the course of ½ h 8¾ parts Zinc dust stirred into this solution. The whole, which is stirred from time to time is left to stand for 4—5 h, and then mixed with 11½ parts Lime, slaked in 30 parts water. After allowing the sediment to settle, 7 parts Soda lye of 36° Tw.



are added to the clear solution; the Hydrosulphite, which is now ready for immediate use is kept in well closed vessels in a dark room.

**Indigo** MLB powder, pat.

**Indigo** MLB extra (99—100%), pat.

**Indigo** MLB/G powder, pat.

**Indigo** MLB paste 20%, pat.

**Indigo** MLB Vat I 20%, pat.

**Indigo** White MLB 40%, pat.

## 25. Colours produced upon the fibre by a process of oxydation.

Aniline Black, Primuline-Chloride of Lime-Yellow.

### Aniline Black.

1. One bath black. The bath is prepared with  
5% Aniline Oil, 12% Muriatic Acid, 6% Bichrome, or  
3,6% Aniline Oil, 3,6% Muriatic Acid, 2% D. O. V,  
7,8% Bichrome (Soda), 0,5% Copper Sulphate. The goods are entered cold, worked for 1 h, then the bath is raised to the boil in another hour, and the goods dyed at the boil for  $\frac{1}{2}$  h. Then they are well rinsed and soaped at the boil (eventually some (1%) Logwood Extract may be added to the soap bath).

### 2. Oxydation Black.

The concentrated bath of 15° Tw. contains p. 1000 parts.

126 parts Aniline salt, 40 parts Chlorate of Soda, 150 parts Acetate of Alumina 21.6° Tw., 5.7 parts Chloride of Ammonia, 3 parts Sulphate of Copper.

The dye-liquid is made to twaddle 12° Tw; and is refreshed and kept stable by additions with a standard solution of 15° Tw.

The goods are impregnated, evenly wrung, opened out, dried and oxydised.

They are then treated for  $\frac{1}{2}$  h in a bath (140° F) containing 2,5% Bichrome, 0,5% Aniline Salt, 0,2% Sulphuric Acid 168 $\frac{1}{2}$ ° Tw., then well rinsed and finally soaped.

### Primuline-Chloride of Lime-Yellow.

The yarn is dyed in the usual manner with Primuline O, rinsed, and then treated for  $\frac{1}{2}$  h in a bath (77° F) containing pro 100 Gall  $\frac{1}{2}$  Gall Chloride of Lime-solution of 15° Tw.

Afterwards the yarn is well rinsed.

An increase of the temperature of the Chloride of Lime bath produces redder shades.

## 26. Colours produced upon the fibre by condensation.

**Nitroso Blue**, prepared with Nitroso Base M 50% paste and Resorcine or Tannoxyphenol. (comp. Cotton printing.)

## 27. Insoluble Azo colours produced direct upon the fibre.

Compare directions for Cotton printing, which contain particulars as to the dyeing of solid shades on piece goods.

For yarn dyeing only Azophor Red is of importance.

### Azophor Red on yarn.

The yarn is boiled in Soda or Soda lye, then washed, hydroextracted and dried.

#### 1. Grounding:

- |                       |   |                                    |
|-----------------------|---|------------------------------------|
| a. for yellowish Reds | { | 20—25 parts $\beta$ -Naphthol,     |
|                       |   | 28—30 parts Soda lye 36° Tw.       |
|                       |   | 60—75 parts Sodium Turkey Red Oil, |
| b. for bluish Reds    | { | 20—25 parts Beta Naphthol R,       |
|                       |   | 40—50 parts Soda lye 36° Tw.       |
|                       |   | 60—75 parts Sodium Turkey Red Oil  |
- per 1000 parts grounding liquid.

The well prepared and dried yarn is treated in 2 lb. lots in a tureen containing about 10 gall. Grounding liquid. After being well kneaded, the yarn is wrung evenly, or each lot hydroextracted separately. For each following lot  $\frac{3}{4}$  litres of grounding liquid is added to the tureen and after hydroextracting, the yarns are dried at 104—122° F.

#### 2. Developing.

4488—5600 grammes Azophor Red PN pat. are made into a paste and dissolved with 30 litres cold water in an upright barrel containing a tap (for letting off the liquid) as near the bottom as possible. After  $\frac{1}{2}$ —1 h the clear solution can be drawn off. The froth, which has risen to the top and thus remained in the cask is then stirred up with 10 litres water and after some time this solution added to the first solution which now contains 40 litres Azophor Red solution A. Before use 10 litres of solution B are slowly added to A.

This consists of 2—2  $\frac{1}{2}$  litres Soda lye and 6—7  $\frac{1}{2}$  litres Water. The developing liquid therefore contains about 50 litres.

The tureen is half filled with this developing liquid and half with cold water. The naphtholated yarn is immersed in this solution in 2 lb. lots, and then wrung out over the tureen. The latter is replenished for each subsequent lot with  $\frac{3}{4}$  litres developing liquid. The yarn is left to lie for about 1 h, and then rinsed in cold water.

#### 3. Soaping.

The soap bath contains for yellow shades of Red 1—2 parts soap p. 1000 parts, and for blue shades of Red 2 parts soap, and  $\frac{1}{4}$ — $\frac{1}{2}$  parts Soda p. 1000 parts. The yarns are soaped for 10—15 min. at 140° F washed and dried.

Azophor Red produces brighter shades on bleached yarn; the yarn may also be bleached after dyeing, which enhances the brilliancy of the Red.

## 28. Sulphide Colours.

The goods are dyed for 1 h. at 176° F with dyestuff-solution and the addition of 10, 20, 30 parts Common salt or calc. Glauber's salt p. 1000 parts according to the depth of shade required. They are then well rinsed and fixed with suitable metal salts at 140° F (or even at a higher temperature) in order to increase the fastness properties. It is advisable to use soft water for dyeing.

**Melanogen G** and T pat.

„ **Blue B** pat.

**Thiogene Brown R** pat.

### Fixing.

1. For **Melanogen G** and T pat.:

- a. 2—4% Sulphate of Copper,
- b. 2—4% Sulphate of Nickel,
- c. 2—3% Sulphate of Zinc and 1—2% Sulphate of Copper.

2. For **Melanogen Blue B** pat:

- a. 2—5% Sulphate of Zinc,
- b. 2—5% Alum,
- c. 1—2% Sulphate of Cadmium,
- d. 1—2% Sulphate of Nickel,
- e. 1—4% Sulphate of Copper,
- f. 2—5% Fixing Salt M.

3. For **Thiogene Brown R** pat.:

- a. 2—3% Copper Sulphate,
- b. 1—2% Copper Sulphate and 2—3% Bichrome,
- c. 3—4% Bichrome.

## b) Cotton Colours classified according to special properties.

### 1. Cotton Colours fast to bleaching.

The following colours may be boiled and bleached (together with undyed material), without being destroyed.

**Alizarine Red No. 1** paste 20% on Alumina or Alumina-Iron or Iron-Mordant as **Old Red, Claret-Red** or **Violet**.

**Alizarine Blue**, all brands on Oil-Tannin-Chrome Mordants.

**Indigo MLB** powder, pat.

**Indigo MLB extra** (99—100%), pat.

**Indigo MLB/G** powder, pat.

**Indigo MLB** paste 20%, pat.

**Indigo MLB Vat I** 20%, pat.

**Indigo White MLB** 40%, pat.

**Oxydation Aniline Black**.

**Alizarine Orange N** paste, **Alizarine Yellow GG** pat., on Chrome Mordant.

**Primuline**, chlorinated.

## 2. Cotton Colours perfectly fast to washing.

The following Colours may be washed in hot soap and soda, without changing their shades materially nor bleeding into white.

**Alizarine Orange N** paste, on Alumina and Chrome Mordants.  
**Alizarine Red** paste 20%, all brands, on Alumina-, Chrome-, Iron- and mixed Mordants.

**Alizarine Claret R** paste, on Alumina- and Chrome Mordant.  
**Alizarine Brown**, all brands, on Alumina- and Chrome Mordant.

**Alizarine Blue**, all brands, on Chrome Mordant.

**Alizarine Darkblue S**, on Chrome Mordant.

**Alizarine Green S**, on Chrome mordant.

**Ceruleine**, all brands, on Chrome and Alumina Mordants.

**Galleine** paste A, on Chrome Mordant.

**Solid Green O**, as Bistreibrown without Mordant, on Chrome and Iron Mordant.

**Indigo MLB** powder, pat.

**Indigo MLB extra** (99—100%), pat.

**Indigo MLB'G** powder, pat.

**Indigo MLB** paste 20%, pat.

**Indigo MLB Vat I** 20%, pat.

**Indigo White MLB** 40%, pat.

**Aniline Black** (one bath and Oxydation Black), pure or with **Melanogen Blue B** pat., **Dianil Black CR** or **PR** pat. as a bottom.

**Primuline O**, chlorinated.

**Melanogen Blue B** pat.

**Melanogen G, T** pat.

**Thiogene Brown R** pat.

**Cresotine Yellow G**, **Dianil Fastbrown B**, **Dianil Brown 3GO**, **Dianil Black N**, **R**, treated with Copper sulphate, Bichrome and Sulphuric acid.

## 3. Cotton Colours, which stand a fair amount of washing and soaping.

Besides those colours which were enumerated under 2, the following dyestuffs withstand washing and soaping fairly well.

a) Alizarines:

**Alizarine Yellow R** and **GG** pat., on Chrome Mordant.

b) Colours, produced on the fibre:

**Orange: Meta-Nitraniline** (Azophor Orange) and  $\beta$ -Naphthol.  
**Red: Paranitraniline** (Azophor Red) and  $\beta$ -Naphthol or  $\beta$ -Naphthol R.

**Claret Red:  $\alpha$ -Naphthylamine** and  $\beta$ -Naphthol.

**Blue: Dianisidine** (Azophor Blue) and  $\beta$ -Naphthol.

**Nitroso Blue.**

c) Basic Colours, on Antimony-Tannin mordant or fixed after dyeing.

**Auramine**, all brands.

**Janus Yellow G**, **Janus Brown B**, R pat.

**Rosazeine 4G** pat.

**Safranine**, all brands.

**Methylene Violet 3R A** extra, 2RA, 2RN, BN.

**Janus Red B** pat.

**Methylene Heliotrope O** pat.

**Methyl Violet 2B**, 6B, **Violet crystals O**.

**Victoria Blue B**.

**Methylene Blue**, all brands, **Marine Blue**, all brands, **Methylene Darkblue RBN**, 3BN, **Methylene Indigo O**, SS.

**Thionine Blue GO**.

**Ethyl Blue BF** pat., **Indamine Blue N** extra, NB extra.

**Indophene Blue B**, G pat.

**Janus Blue R**, G, pat., **Janus Darkblue R**, B, pat.

**Methylene Green O**, extra yellow conc., GG.

**Janus Green G**, B, pat., **Janus Black I** pat.

**Brilliant Green**, all brands, **Malachite Green**, all brands.

**Methylene Grey**, all brands, **New Methylene Grey G** powder.

**Nigrosine**, all brands.

d) Direct dyeing Colours.

**Oxydianil Yellow O**, **Dianil Yellow 2R**, 3G, pat., fixed with Chrome or Chrome-copper.

**Dianil Direct Yellow S**, **Cresotine Yellow G**, **Dianil Fast-Brown B**, fixed with Chrome or Chrome-Copper.

**Primuline O** developed with Azophor Red or Azophor Orange, also diazotised and developed with Ammonia, Phenol, Resorcine or  $\beta$ -Naphthol.

**Primuline O**, developed with  $\beta$ -Naphthol and treated with Solidogen A pat.

#### 4. Cotton Colours which are fast to water.

Besides those dyestuffs which were enumerated under 2 and 3, the following colours are fast to water.

a) Basic Colours.

**Azophosphine GO** pat.

**Janus Yellow R** pat.

**Phosphine**, all brands.

**Chrysoidine**, all brands.

**Vesuvine**, all brands.

**Cutch Brown D**, **Dark Brown M**, **Brown A**,

**Scarlet for Cotton O**.

**Magenta**, all brands.

**New Magenta O**, P pat.

**Cerise G**, R, **Grenadine**, all brands, **Maroon** extra.

**New Fast Blue 3R** cryst., **Fastblue for cotton**, all brands.

**Methyl Violet**, all brands.

## b) Direct Colours.

Dianil Yellow R pat., Dianil Orange F pat., Dianil Brown 3GO. B, BD, D, R, G, M, Dianil Japonine G, dyed direct.  
 Dianil Blue G, B, R, 2R, 3R, 4R, BX, pat., developed with Chrome.  
 Dianil Darkblue 3R. pat., dyed direct.  
 Dianil Indigo O pat., treated with copper or fixed with Chrome-Copper.  
 Dianil Black pat., all brands, dyed direct.  
 Dianil Claret Red G, B, treated with Solidogen.

## c) Resorcine Colours.

Eosine, Erythrosine, Phloxine, Rose Bengale, Eosine Scarlet, Cyanosine, all brands, fixed with Chrome or treated with Solidogen.

## 5. Cotton Colours fast to perspiration.

All colours with exception of:

|                          |                                      |  |
|--------------------------|--------------------------------------|--|
| Brilliant Orange         | } all brands                         |  |
| Brilliant Croceine       |                                      |  |
| Eosine, all brands       | } without Solidogen after-treatment. |  |
| Erythrosine, all brands  |                                      |  |
| Phloxine, all brands     |                                      |  |
| Rose Bengale, all brands |                                      |  |

## 6. Cotton Colours fast to acids.

Fast to boiling in acid are:

Alizarine Red, all brands, on Old red mordant.  
 Alizarine Blue, all brands, on Oil, Tannin and Chrome mordant.  
 Ceruleine, all brands, on Oil, Alumina or Oil-Chrome mordant.  
 Alizarine Orange N paste on Chrome mordant.  
 Aniline Black.  
 Indigo MLB powder, pat.  
 Indigo MLB extra (99–100%), pat.  
 Indigo MLB/G powder, pat.  
 Indigo MLB paste 20%, pat.  
 Indigo MLB Vat I 20%, pat.  
 Indigo White MLB 40%, pat.  
 Solidgreen-Bistre.  
 Primuline, chlorinated  
 Primuline Red, fixed with Solidogen, or developed by the other well known methods.  
 Melanogen Blue B pat.  
 Melanogen T, G, pat.  
 Thiogene Brown R pat.  
 Cresotine Yellow G.  
 Dianil Brown 3GO.  
 Dianil Fast Brown B  
 Dianil Black CR, R, G, N, pat. } chromed in an acid bath.

Fairly fast to boiling in acid are:

a) Basic dyestuffs:

**Auramine**, all brands.

**Safranine**, all brands.

**Janus Brown B** pat.

**Methylene Blue BB** conc., **Thionine Blue GO**.

**Indamine Blue N**, **NB** extra, **Ethyl Blue BF** pat.

**New Fast Blue 3R** cryst.

**Indophene Blue B**, **G**, pat.

**Janus Blue G**, **R**, pat.

**Methylene Green** extra yellow, **Methylene Grey**, all brands.

**Methylene Heliotrope O**.

b) Dianil dyestuffs:

All colours treated with Solidogen, with exception of **Dianil Red 4B**, **Dianil Claret Red B**, **G**.

|                                                   |                                      |
|---------------------------------------------------|--------------------------------------|
| <b>Dianil Orange N</b> , <b>Toluylen Orange R</b> | } after treated with<br>Azophor Red. |
| <b>Dianil Brown</b> , all brands                  |                                      |
| <b>Dianil Darkblue R</b> , <b>3R</b> pat.         |                                      |
| <b>Dianil Black</b> , all brands pat.             |                                      |

|                                                      |                                 |
|------------------------------------------------------|---------------------------------|
| <b>Dianil Brown 3GO</b>                              | } after treated with<br>Copper. |
| <b>Dianil Japonine G</b> , <b>Dianil Fastbrown B</b> |                                 |
| <b>Dianil Darkblue R</b> , <b>3R</b> pat.            |                                 |
| <b>Dianil Black CR</b> pat.                          |                                 |

## 7. Cotton Colours which stand crabbing and boiling in acids.

The following dyestuffs are suitable for warps and fancy styles in half wool dyeing.

**Indigo MLB** powder, pat.

**Indigo MLB** extra (99—100%), pat.

**Indigo MLB/G** powder, pat.

**Indigo MLB** paste 20%, pat.

**Indigo MLB Vat I** 20%, pat.

**Indigo White MLB** 40%, pat.

**Aniline Black**.

**Primuline O**, chlorinated, diazotised and developed, diazotised, developed and treated with Solidogen A pat.

**Melanogen Blue B** pat.

**Melanogen T**, **G**, pat., **Thiogene Brown R**, pat.

**Methylene Grey**, all brands, **New Methylene Grey G**, **Ethyl Blue**, **BF** pat. on Tannin mordant.

**Janus Yellow R** pat., **Janus Brown B**, **R**, pat., **Janus Blue R**, **G**, pat., fixed.

**Cresotine Yellow G**, **Dianil Brown 3GO**, **Dianil Fastbrown B**, **Dianil Black CR**, **N**, **R**, **G**, pat., chromed in an acid bath.

## 8. Cotton Colours fast to ironing.

The following dyestuffs stand hot ironing without changing their shade.

- Phosphine, all brands, Azophosphine GO, BRO, pat.  
 Chrysoïdine A cryst., C cryst., C extra cryst., Vesuvine, all brands, Cutch Brown D, G, Darkbrown M, MB, Magenta, all brands, New Magenta O pat., Cerise, all brands, Grenadine, all brands, Maroon O, extra, Cardinal R, G.  
 Cotton Scarlet O.  
 Safranine, all brands, Methylene Violet, all brands, Methylene Heliotrope.  
 Rosolane O pat.  
 Methyl Violet, all brands with exception of 4 R and 5 R, Violet crystals O, Malachite Green, all brands, Brilliant Green, all brands, Victoria Blue B.  
 Rosazeïne 4 G pat.  
 Conc. Cotton Blue, all brands, Pure Blue, China Blue, all brands, Methyl Blue for Cotton MLB, Methylene Blue, all brands, Thionine Blue GO, Indamine Blue N extra. Ethyl Blue BF, Methylene Indigo O, SS, Methylene Darkblue RBN, 3 BN.  
 Methylene Green, all brands.  
 Fast Blue for Cotton, all brands, New Fast Blue 3 R cryst.  
 Methylene Grey, all brands, New Methylene Grey O, Nigrisine O.  
 Janus Yellow G, R, pat.  
 Janus Brown R. B, pat.  
 Janus Red B pat.  
 Janus Blue G, R, pat., Janus Green G, B, pat.  
 Janus Black I pat.  
 Primuline O chlorinated, also diazotised and developed.  
 Oxy Dianil Yellow O.  
 Dianil Yellow 3 G, G, R pat., Dianil Direct Yellow S, Cresotine Yellow G, Aurophenine O.  
 Dianil Orange G pat., N, Toluylene Orange R.  
 Dianil Scarlet G, 2 R, pat., Dianil Red R, 4 B, 10 B.  
 Brilliant Dianil Red R, R conc., Deltapurpurine 5 B, Dianil Green G pat.  
 Dianil Blue G, B, R, 2 R 3 R, 4 R, E, ET, BX, pat.  
 Dianil Darkblue R, 3 R, pat. with exception of Azophor developed shades.  
 Dianil Black R, G, CR, T, CB, AC, HW, RN extra pat., PR, PG, Dianil Newblack LBI pat.  
 Dianil Brown 3 GO, 2 G, G, R, BD, D, B, Dianil Fastbrown B.  
 Alizarine Yellow GG pat. N, R.  
 Alizarine Orange N, Alizarine Brown, all brands.  
 Alizarine Red, all brands, Alizarine Claret R paste.  
 Alizarine Blue, all „S“ brands, Alizarine Darkblue S, Alizarine Green S paste.  
 Ceruleïne conc., S, S conc., paste SW.  
 Galleïne, all brands.  
 Solidgreen O 50%.



Indigo MLB powder, pat.  
 Indigo MLB extra (99—100 %), pat.  
 Indigo MLB/G powder, pat.  
 Indigo MLB paste 20 %, pat.  
 Indigo MLB Vat I 20 %, pat.  
 Indigo White MLB 40 %, pat.  
 Aniline Black.  
 Nitrosoblue.  
 Para Nitraniline Red, Meta Nitraniline Orange, Dianisidine Blue  
 Melanogen Blue B pat.  
 Melanogen G, T, pat.  
 Thiogene Brown R pat.

## 9. Cotton Colours fast to steaming.

Indigo MLB powder, pat.  
 Indigo MLB extra (99—100 %), pat.  
 Indigo MLB/G powder, pat.  
 Indigo MLB paste 20 %, pat.  
 Indigo MLB Vat I 20 %, pat.  
 Indigo White MLB 40 %, pat.  
 Aniline Black.  
 Solidgreen Bistre.  
 Alizarine Colours.  
 Basic Colours on Tannin-Antimony Mordant.  
 Janus Colours, dyed on a mordant and fixed after dyeing.  
 Dianil Colours fixed with metal-salts, developed with Azophor-  
 or Naphthol.  
 Melanogen Blue B pat., Melanogen G, T, pat.  
 Thiogene Brown R pat.  
 Paranitraniline Red.  
 Metanitraniline Orange.  
 Naphthylamine Claret.  
 Dianisidine Blue.  
 Nitrosoblue.

## 10. Cotton Colours fast to milling.

The following dyestuffs stand the milling process without changing their shades nor bleeding.

Alizarine Yellow GG pat., Chrome Mordant.  
 Alizarine Orange, all brands, Chrome and Alumina Mordant.  
 Alizarine Red, all brands, Alumina, Chrome, Iron and mixed  
 Mordants.  
 Alizarine Claret R paste, Alizarine Brown, Alumina and Chrome  
 Mordant.  
 Alizarine Blue, Alizarine Darkblue, Alizarine Green S, all  
 brands, Chrome Mordant.  
 Ceruleine, all brands, Alumina and Chrome Mordant.

Galleïne, all brands, Chrome Mordant.

Solidgreen Bistre, Chrome and Iron Mordant.

Nitrosoblue.

Indigo MLB powder, pat.

Indigo MLB extra (99—100%), pat.

Indigo MLB/G powder, pat.

Indigo MLB paste 20%, pat.

Indigo MLB Vat I 20%, pat.

Indigo White MLB 40%, pat.

Aniline Black.

Primuline O, chlored.

Cresotine Yellow G

Dianil Brown 3GO

Dianil Fastbrown B

Dianil Black CR, G, N, R pat.

} chromed in an acid bath.

Melanogen Blue B, pat., Melanogen G, T, pat.

Thiogene Brown R pat.

Fairly fast to milling are:

Janus Yellow G pat., Janus Brown B, R, pat.

Methylene Heliotrope O.

Indamine Blue N, NB extra.

Ethyl Blue BF pat.

Janus Blue R, G, pat.

Indophene Blue B, G, pat.

Methylene Grey, Methylene Green all brands.

Janus Green G, B, pat.

Methylene Violet 3RA extra.

Primuline O, developed.

Dianil Brown BD, R, 3GO, Dianil Fastbrown B, Dianil Japonine G, Chrome-Copper Development.

Dianil Darkblue R, 3R, pat., Dianil Black CR pat., treated with copper or developed with Azophor Red or Naphthol.

Dianil Black R, G, N, E, T, pat., developed.

In light shades also direct shades of:

Dianil Yellow, Dianil Direct Yellow S, Dianil Blue, Dianil Brown, all brands.

## 11. Cotton Colours fast to Chlorine.

The following dyestuffs withstand the process of chlorinating with Chloride of lime, as is required for certain trades.

Alizarine Red No. 1, on Alumina-, Iron- and Alumina-Iron Mordant.

Alizarine Orange on Chrome Mordant.

Alizarine Yellow R, GG, pat. on Chrome Mordant.

Alizarine Blue F, SB, A, Alizarine Darkblue, on Chrome Mordant.

Aniline Black.

Indigo MLB powder, pat.

Indigo MLB extra (99—100%), pat.

Indigo MLB/G powder, pat.

Indigo MLB paste 20%, pat.  
 Indigo MLB Vat I 20%, pat.  
 Indigo White MLB 40%, pat.  
 Primuline O, chlorod.  
 Dianil Direct Yellow S, Oxydianil Yellow O.  
 Aurophe-nine O.  
 Metanitraniline Orange.  
 Paranitraniline Red.  
 Naphthylamine Claret.

## 12. Cotton Colours fast to stoving.

Oxydianil Yellow O.  
 Aurophe-nine O, Cresotine Yellow G, Dianil Direct Yellow S.  
 Primuline O, chlorinated.  
 Dianil Orange G, pat., N, Toluy-lene Orange R, Dianil  
 Brown 3GO, R, BD, Dianil Fast Brown B, Dianil Black  
 CR, N, pat., Dianil Darkblue R, 3R, pat. developed with  
 Azophor.  
 Melanogen Blue B pat.  
 Melanogen G, T, pat.  
 Thiogene Brown R, pat.

## 13. Cotton Colours fast to rubbing and mangling.

Primuline O, and all Dianil Colours, (dyed direct, or developed with Azophor or Naphthol, or fixed with Metal salts or Solidogen) are perfectly fast to rubbing and mangling. Likewise:

Melanogen Blue B pat., Melanogen T, G, pat.  
 Thiogene Brown R pat.  
 Aniline Oxydation Black.  
 Nitroso Blue.  
 Solidgreen-Bistre.

Fairly fast to rubbing and mangling are:

Alizarine Colours on Old Red Oil grounding with Alumina, Chrome, Iron or mixed mordants; also the following basic colours on Tannin mordant (or after-treated with Tannin):

Auramine, all brands.  
 Phosphine, Azophosphine pat., all brands.  
 Chrysoidine, all brands.  
 Janus Yellow G pat.  
 Rosazeïne, all brands.  
 Safranine, all brands.  
 Methylene Violet, Methylene Heliotrope O, Methylene Blue, Thionine Blue, all brands.  
 Ethyl Blue BF pat.

New Fast Blue 3R cryst., Fast Blue for Cotton, all brands.  
 Indamine Blue N extra, NB extra.  
 Indophene Blue B, G, pat.  
 Janus Blue R, G, pat., Janus Darkblue R, B, pat., Janus  
 Green G, B, pat.  
 Methylene Green, Methylene Grey, all brands.

## 14. Cotton Colours fast to light.

The following dyestuffs are distinguished for their great fastness to light.

Alizarine Yellow R, GG pat. on Chrome Mordant.  
 Alizarine Orange on Alumina- and Chrome Mordants.  
 Alizarine Red, all brands, on all Mordants.  
 Alizarine Claret R paste, on all Mordants.  
 Alizarine Blue, all brands, on Chrome Mordant.  
 Alizarine Green S, on Chrome Mordant.  
 Alizarine Brown, all brands, on Chrome- and Alumina Mordants.  
 Ceruleine, all brands, on Chrome- and Alumina Mordants.  
 Solidgreen paste 50% on Iron Mordant.  
 Aniline Black.  
 Indigo MLB powder, pat.  
 Indigo MLB extra (99—100%), pat.  
 Indigo MLB/G powder, pat.  
 Indigo MLB paste 20%, pat.  
 Indigo MLB Vat I 20%, pat.  
 Indigo White MLB 40%, pat.  
 Primuline O, chlorinated.  
 Oxydianil Yellow O.  
 Cresotine Yellow G, after treated with copper, Aurophe-nine O.  
 Melanogen Blue B pat., treated with Cadmium, Nickel, Copper  
 or Fixing Salt M.  
 Melanogen G, T, pat.  
 Thiogene Brown R pat.  
 Methylene Green, all brands.

The following dyestuffs are very fast to light.

### a) Mordant Colours.

Galleine, all brands, on Chrome Mordant.

### b) Insoluble Azo Colours developed upon the fibre.

Paranitraniline Red.  
 Dianisidine Blue.  
 Solidgreen Bistre.

### c) Basic Colours.

Auramine, all brands.  
 Phosphine, all brands.  
 Janus Yellow G, R, pat.

Rosolane pat., all brands.

Safranine, all brands.

Methylene Violet, Methylene Heliotrope O, Methylene Blue, Thionine Blue, all brands, Methylene Indigo O, SS.

Ethyl Blue BF, BD, RD, pat.

New fast Blue 3R cryst., Fastblue for cotton, all brands.

Indamine Blue N extra, NB extra.

Indophene Blue B, G, pat.

Janus Blue R, G, B, pat.

Methylene Grey, all brands, New Methylene Grey O, Nigrisine O.

#### d) Direct Colours.

Dianil Yellow 3G pat., after treated with Copper.

Dianil Yellow R, 2R, pat.

Dianil Direct Yellow S, Cresotine Yellow G.

Dianil Orange G pat., N, Toluylene Orange R.

Dianil Blue G, B, R, 2R, 4R, pat., after treated with Copper.

Dianil Darkblue R, 3R, pat., after treated with Copper or developed with  $\beta$ -naphthol.

Dianil Black R, G, T, E, RN extra, pat., direct or developed.

Dianil Black CR pat., treated with Chrome and Copper.

Dianil Brown 3GO, 2G, Dianil Fastbrown B, Dianil Japone G, direct or treated with Chrome or Copper.

Dianil Brown 3GO, treated with Azophor.

#### e) Sulphide Colours.

Melanogen Blue B pat., treated with Alumina, Zinc or Chrome.

## C. SILK DYEING.

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### a. Silk Colours classified according to their method of dyeing.

#### 1. Silk Colours, dyeing in acidified boiled off liquor.

The dyebath is prepared with the required amount of Sulphuric or Acetic Acid, then the boiled off liquor (50—100 parts per 1000) is added and finally the colour solution poured into this bath. The silk is entered at 86—104° F the temperature slowly raised to 203° F and the dyeing operation carried on until the bath is nearly exhausted. After dyeing the material is rinsed and lusted in a weak acid bath.

Piece material is generally dyed in an acid bath without the addition of boiled off liquor.

#### a) With sulphuric acid.

**Acid Magenta**, all brands, **Acid Maroon O**, **Acid Cerise O**, **Orseilline R** and **B**.

**Acid Violet 4RS**, **3RS**, **3RA**, **R conc. new**, **N**, **5BF**, **7BN**.

**Methyl Blue** for Silk **MLB**, for cotton **MLB**, **Opal Blue** superior, **Blue** for Silk **T conc.**, **T**, greenish, **No. 99**, **KR**, **Opalblue** blue shade, **Bleu de Lyon O**, **R**, spirit.

**Victoria Blue B**.

**Acid Green**, all brands.

**Patentblue A**, **V**, superior, **L**, **N**, pat.

**Keton Blue 4BN sol.**, **4BN powder**, pat.

**Violamine G**, **R**, **A2R**, **B**, **3B**, pat.

**Fastblue**, all brands, **Blackblue O**, **Black Black O**, **Fastdark-blue R**.

**Nigrosine No. 1—4**, **D spirit.**, **Silk Grey O**, **R** fast to water.

**Chinoline Yellow O**.

**Naphthol Yellow S**.

**Flavazine S**, **L**, **T**.

**Azo Yellow conc.**, **Victoria Yellow conc.**

**Orange No. 4**, **G**, **No. 2**, **Brilliant Orange O**, **G**, **R**.

**Fast Brown O**, yellow shade, **Azo Brown V**.

**Scarlet**, all brands, **Scarlet 6 R** cryst.

**Diamond Scarlet** for Silk G, **Scarlet** for Silk O, G, 2G.  
**Brilliant Croceïne**, all brands, **Fastred O**, S, **Brilliant Crimson O**.  
**Amaranth O**, **Victoria Rubine O**, **Claret Red G**, R, B, 3B.  
**Amido Naphthol Black 4B**, 4B extra, 6B, S.

## b) With acetic acid.

**Auramine**, all brands, pat.  
**Phosphine** new.  
**Vesuvine** conc., 3R superior, 4BG conc., extra yellow.  
**Magenta** large cryst., small cryst., **Maroon O**, **Cerise G**, **Grenadine O**, **Cardinal R**.  
**New Magenta O** pat.  
**Safranine**, all brands.  
**Malachitegreen** cryst. extra, **Brilliantgreen** cryst. extra.  
**Methyl Violet**, all brands.  
**Violet crystals O**.  
**Methylene Blue** BB extra, BB conc., BB, R, 2R, 6R.  
**Methylene Green O**, G, 2G, 3G, extra yellow, extra yellow conc.  
**Primula R**, B, **Methylene Violet 2RA**, 2RN, BN, pat.  
**Rosolane T**, O, BO, R paste, B paste.  
**Victoria Blue B**.  
**Methylene Grey O**, NF.  
**Eosine** extra spirit. sol., **Cyanosine O** spirit. sol.  
**Eosine** extra AG, BB, **Erythrosine** yellow shade, blue shade, extra blue shade N, blue shade N, extra N, yellow shade N,  
**Phloxine GA** extra, BA extra, G, O, 2B, 5B, **Rose Bengale G**, B.  
**Rosazeïne O**, B, extra, B extra, 4G, 4G extra, pat.  
**Violamine R**, B, 3B, A2R, pat.  
**Patentblue A**, V, N, G, L, superior, pat.  
**Janus Yellow G**, R, pat.  
**Janus Red B** pat.  
**Janus Brown R** pat.  
**Dianil Yellow R**, 2R, 3G, pat.  
**Aurophenine O**.  
**Dianil Orange G** pat., N.  
**Dianil Red 4B**, **Brilliant Dianil Red R**, **Delta Purpurine 5B**.  
**Dianil Blue G**, B, R, pat.  
**Dianil Brown 3GO**, R, BD.

## 2. Silk Colours dyeing in a neutral (or alkaline) soap bath.

The bath is prepared with Olive Oil Soap (10—12 parts per 1000) and the colour solution added. After having raised the temperature to the boil, the silk is dyed for  $\frac{1}{2}$ — $\frac{3}{4}$  h. (It is advisable to boil the bath up once more during this time.) Then the material

is rinsed in water, which ought to be free from lime, and soured with Muriatic or Sulphuric Acid at 140–176° C.

**Alkaline Blue R** conc., 2B, 4B, 6B.

**Alkaline Blue** 2OL, 4C, 7C.

**Methyl Alkali Blue** MLB.

**Alkaline Violet O.**

### 3. Silk Colours dyeing on a mordant.

The silk is first boiled off, then washed at 86–104° F with clean water and dried. It is then steeped for 12–24 h in the mordant which consists of

Nitrate Mordant 15° Tw. or of  
Chloride of Chrome S 34° Tw.

After mordanting, the Silk is well washed in clean water, (free from lime if possible) and then dyed. The dyeliquid consists of boiled off liquor diluted in equal parts with water. The Alizarine Colours are stirred into this bath (cold). The silk material is entered cold, then the temperature slowly raised to the boil and the dyeing operation carried out for about 2 h; the temperature ought to remain for at least 1 h at 194–210° F.

After dyeing, the silk is well washed in water which ought to be free from lime, hydroextracted and then soaped in a neutral soap bath (5–7 parts of soap per 1000 parts of liquid) for 1½ h at the boil, then washed again and finally lusted with Tartaric or Acetic Acid. It is advisable to add to the last bath (lustering) some Olive Oil, previously boiled with a little Soda. Boiled off liquor containing Tin (originated by material which was prepared with Tin solutions) ought never to be used.

The Nitrate mordant for light shades can be diluted to 3–7.4° Tw. Care must be taken to get the silk wetted through with the mordant, before it is steeped over night, for the places, which have not been moistened sufficiently, will remain white in the subsequent dyeing process.

**Alizarine Yellow** GG paste pat., R paste.

**Alizarine Orange** paste.

**Alizarine Red** RX, S, SDG, 4 BN paste 20%.

**Alizarine Claret** paste R.

**Alizarine Brown** paste.

**Alizarine Blue** DNX paste.

**Ceruleine** paste A.

**Galleine** paste A.

### 4. Primuline.

The Silk is dyed for 1 h at the boil in a bath which is made acid with Acetic Acid and contains 10% **Primuline O.**



It is then rinsed and diazotized for  $\frac{1}{2}$  h cold with

3% Nitrite of Soda

5% Sulphuric Acid 168 $\frac{1}{2}$ ° Tw.

Then rinsed again, and developed cold for  $\frac{1}{2}$  h with

1.2% Beta Naphthol

1% Soda lye 77° Tw.,

rinsed again and soaped  $\frac{1}{2}$  h at the boil with 5 parts of Olive Oil soap per 1000 parts of water. Finally the material is lustred with Acetic Acid.

## b) Silk colours classified according to different properties.

### 1. Silk Colours which equalize on tin-weighted material.

Magenta large cryst., small cryst., New Magenta O pat.

Malachite Green cryst. extra, Brilliant Green cryst. extra.

Methyl Violet B, 6B, R, 5R, Primula R, B.

Violet cryst. O, Victoria Blue B.

Methylene Blue BB extra, BB conc., BB, R, 6R, Methylene Green O, G, 2G, 3G, extra yellow, extra yellow conc.

Safranine, all brands, Methylene Violet 2RA, 2RN, BN.

Rosolane T, O, BO, R paste, B paste.

Coalblack O, I and II.

Rosazeïne, all brands.

Eosine extra spirit., Cyanosine O spirit.

Eosine extra, AG, BB, Erythrosine yellow shade, blue shade, extra blue shade N, blue shade N, extra N, yellow shade N, Phloxine GA extra, BA extra, G, O, 2B, 5B, Rose Bengale G, B.

Violamine pat., all brands.

Alkaline Blue R conc., 2B, 4B, 6B, 2OL, 4C, 7C, Methyl Alkaline Blue MLB.

Patent Blue V, superior, L, N, pat.

Fast Darkblue R.

Chinoline Yellow O.

Naphthol Yellow S.

Flavazine S, L, T.

Azo Yellow conc.

Orange G, No. 2, Brilliant Orange O, G, R.

Diamond Scarlet for Silk G, Scarlet for Silk O, G, 2G.

Scarlet G, R—6R, B extra, for Silk.

Fast Red O, Brilliant Crimson O, Amaranth O.

Brilliant Croceïne, all brands.

## 2. Silk Colours which equalize on material weighted before or after dyeing with gallic acid.

Auramine conc., Phosphine new.

Vesuvine conc., 3R superior, 4BG conc., extra yellow.

Magenta large cryst., small cryst., Maroon O, Cerise G, Grenadine O, Cardinal R.

New Magenta O pat.

Methyl Violet B, 6B, R, 5R, Primula R, B, Violet cryst. O.

Methylene Blue BB extra, BB conc., BB, R, 6R, Methylene

Green O, G, 2G, 3G, extra yellow, extra yellow conc.,

Methylene Violet 2RA, 2RN, BN.

Safranine conc.

Rosolane O, B, BO, B paste, R paste.

Methylene Grey O, NF.

Rosazeine O, B, extra, B extra, 4G, 4G extra, pat.

Scarlet for Silk, G, 2G, O, Scarlet B extra, Diamond Scarlet for Silk G.

Fastred O.

## 3. Silk Colours, which excel as regards equalizing.

Magenta large cryst., small cryst., New Magenta O pat.

Malachite Green cryst. extra, Brilliant Green cryst. extra.

Methyl Violet B, 6B, R, 5R, Primula R, B.

Violet cryst. O.

Victoria Blue B.

Methylene Blue BB extra, BB conc., BB, R, 6R, Methylene

Green O, G, 2G, 3G, extra yellow, extra yellow conc.

Safranine, all brands, Methylene Violet 2RA, 2RN, BN.

Rosolane T, O, BO, R paste, B paste.

Coalblack O, I and II.

Rosazeine, all brands.

Eosine extra spirit., Cyanosine O spirit.

Eosine extra, AG, BB, Erythrosine yellow shade, blue shade,

extra blue shade N, blue shade N, extra N, yellow shade N,

Phloxine, all brands, Rose Bengale G, B.

Violamine pat., all brands.

Alkaline Blue R conc., 2B, 4B, 6B, 2OL, 4C, 7C, Methyl

Alkaline Blue MLB.

Fast Darkblue R.

Chinoline Yellow O.

Naphthol Yellow S.

Flavazine S, L, T.

Azo Yellow conc.

Orange G, No. 2, Brilliant Orange O, G, R.

Diamond Scarlet for Silk G, Scarlet for Silk O, G, 2G.

Scarlet G, R-6R, B extra, for Silk.

Brilliant Crimson O, Amaranth O.

Brilliant Croceine, all brands.

#### 4. Silk Colours for shading off logwood black.

Auramine conc.

Magenta large cryst., small cryst., New Magenta O.

Methyl Violet, all brands.

Methylene Blue BB extra, BB conc., BB, Methylene Green O, G, GG, 3G, extra yellow, extra yellow conc.

Alkaline Blue R conc., 2B, 4B, 6B, 2OL, 4C, 7C, Methyl Alkaline Blue MLB, Alkaline Violet O.

#### 5. Silk Colours for dyeing white.

Methyl Violet 2B chem. pure, 6B chem. pure.

Rosolane, all brands.

Bleu de Lyon spirit., Blue No. 1 spirit.

#### 6. Silk Colours which stand the boiling off process.

Victoria Blue B.

Primuline O, devel. with Beta Naphthol.

Alizarine Yellow GG pat. paste, R paste, (only on Chrome Mordant).

Alizarine Orange paste.

Alizarine Red RX, S, SDG, 4BN paste 20%.

Alizarine Claret R paste.

Alizarine Brown paste.

Alizarine Blue DNX paste.

Ceruleine paste A.

Galleine paste A.

#### 7. Silk Colours which stand boiling in water.

Alizarine Yellow GG paste pat., R paste (only on Chrome Mordant).

Alizarine Orange paste.

Alizarine Red RX, S, SDG, 4BN paste 20%.

Alizarine Claret R paste.

Alizarine Brown paste.

Alizarine Blue DNX paste.

Ceruleine paste A.

Galleine paste A.

Primuline O, devel. with Beta Naphthol.

## 8. Silk Colours which stand rain.

Janus Yellow G, R, pat.

Janus Red B pat.

Janus Brown R pat.

Dianil Yellow R, 2R, 3G, pat.

Dianil Blue R, B, G, pat.

Alizarine Yellow GG paste pat., R paste, only on Chrome Mordant.

Alizarine Orange paste.

Alizarine Red RX, S, SDG, 4NB paste 20%.

Alizarine Claret R paste.

Alizarine Brown paste.

Alizarine Blue DNX paste.

Ceruleine paste A.

Galleine paste A.

Violamine, all brands.

Bleu de Lyon O spirit., R spirit.

Primuline O, developed with Beta Naphthol.

Further all basic Colors and Fastred O, treated with Tannin.

## 9. Silk Colours which stand soaping at 140° F.

Janus Yellow G, R, pat.

Janus Red B pat.

Janus Brown R pat.

Alizarine Yellow GG paste pat., R paste, (only on Chrome Mordant).

Alizarine Orange paste.

Alizarine Red RX, S, SDG, 4NB paste 20%.

Alizarine Claret R paste.

Alizarine Brown paste.

Alizarine Blue DNX paste.

Primuline O, developed with Beta Naphthol.

## 10. Silk Colours which stand light well.

Rosazeine, all brands.

Violamine G, R, 2R, A2R, B, 3B, pat.

Patentblue A, V, N, L, superior, pat.

Methyl Blue for Silk MLB, for Cotton MLB, Opal Blue superior, blue shade, Bleu de Lyon O spirit, R spirit.

Blue for Silk 99, KR, T conc., T, green shade.

Fastdarkblue R.

Flavazine S, L, T.

Azo Yellow conc., Victoria Yellow conc.

Orange G, No. 2, Brilliant Orange G, O, R.  
 Scarlet G, R-6R, B extra, M old, M new, for silk, 2G, O,  
 Diamond Scarlet for Silk A.  
 Fastred O, Brilliant Crimson O, Amaranth O.  
 Brilliant Croceine, all brands.  
 Alizarine Yellow GG paste pat., R paste (only on Chrome  
 Mordant).  
 Alizarine Orange paste.  
 Alizarine Red RX, S, SDG, 4NB paste 20%.  
 Alizarine Claret R paste.  
 Alizarine Brown paste.  
 Alizarine Blue DNX paste.  
 Ceruleine paste A.  
 Galleine paste A.

## 11. Silk Colours which stand light well on tin weighted material.

Violamine, all brands, pat.  
 Fastdarkblue R.  
 Dianil Yellow R, RR, pat.  
 Orange G, No. 2.  
 Scarlet for Silk, O, G, GG, Diamond Scarlet for Silk G.  
 Scarlet G, R, 5R, B extra, for silk.  
 Fastred O, Brilliant Crimson O, Amaranth O.  
 Brilliant Croceine, all brands.

## 12. Silk Colours fast to stoving.

Rosolane T, O, BO, R paste, B paste.  
 Methyl Violet B, 6B, R, 5R.  
 Victoria Blue B.  
 Janus Yellow G, R, pat., Janus Red B pat.  
 Rosazeine pat., all brands.  
 Eosine extra AG, extra BB, extra spirit, Cyanosine O spirit,  
 Phloxine GA extra, BA extra, G, O, 2B, 5B, Erythrosine  
 yellow shade, blue shade, extra blue shade N, blue shade N, extra  
 N, yellow shade N, Rose Bengale G, B.  
 Violamine, all brands, pat.  
 Acid Violet 5BF, 3RA, 7BN.  
 Alkaline Blue R conc., 2B, 4B, 6B, 2OL, 4C, 7C, Methyl  
 Alkaline Blue MLB, Alkaline Violet O.  
 Patentblue A, N, B, pat. Cyanine B pat., Ketone Blue 4BN  
 solution pat.  
 Fastblue G extra, O, 5R, extra, Black Blue O, Black Black  
 O, Fastdarkblue R.  
 Chinoline Yellow O, Naphthol Yellow S.  
 Flavazine S, L, T.  
 Azo Yellow conc.

**Orange G**, No. 2, **Brilliant Orange O**, G, R.

**Scarlet G**, R, 4 R, **Scarlet** cryst. 6 R.

**Brilliant Croceïne**, all brands, **Brilliant Crimson O**.

**Scarlet** for Silk O, G, 2 G, **Diamond Scarlet** for Silk G.

### 13. Silk colours which stand topping in an acid bath.

All **basic colours** after-treated with tannin.

All **Alizarine Colours**, **Alizarine Yellow GG** paste pat. and R paste only on Chrome mordant.

**Primuline Red** (Primuline O and Beta Naphthol) topped in an Acetic Acid bath.

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## D. HALF WOOL DYEING.

(Cotton and Wool Union fabrics.)

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### 1. Wool Colours, which leave cotton threads perfectly white.

Dyed in an Acid bath:

Acid Magenta, all brands, Acid Violet 4 RS, 3 RS.

Acid Green, all brands.

Patentblue V, N, L, LL, superior, pat., Cyanine B pat.,

Keton Blue 4 BN pat.

Naphthalene Green V, conc., pat., Naphthalene Blue B, B extra, D, pat.

Chinoline Yellow O.

Naphthol Yellow S, SE.

Flavazine T.

Orange G.

Scarlet R—6 R, Scarlet 6 R cryst.

Victoria Rubine O, G. Naphthol Red O.

Victoria Scarlet RR, 3 R, 4 R, 5 R, 6 R, New Coccine O.

Archil Substitute G pat.

Alkaline Fastred R pat., Azo Acid Carmine B pat.

Azo Acid Magenta G, 6 B.

Chromotrope G, 2 R, 2 B, 6 B, 8 B, 10 B, pat.

Victoria Violet 4 BS, 8 BS, pat., Azo Acid Blue B pat.

Azo Acid Black B, G, 3 BL, 3 BL extra, BL, GL, TL conc., TL extra, pat.

Dyed in an Acid bath and developed with Fluoride of Chrome:

Acid Alizarine Blue BB pat.

Acid Alizarine Green G pat.

Mordant Yellow O.

Alizarine Red 1 WS.

Dyed in an Acid bath and developed with Bichrome:

Chromogen I pat.

Chromotrope FB, F4B, 8 B, 10 B, S, pat.]

Acid Alizarine Grenade R.

Mordant Yellow O.

Alizarine Red 1 WS.

The white becomes purer, as the bath is made more acid. It is also of importance to rinse the goods directly after dyeing and then to hydroextract and dry them, in order to prevent the colour from bleeding into the cotton.

## 2. Dianil Colours, which dye wool and cotton alike in a Glauber's salt bath.

Dianil Yellow 3G, R, RR, pat., Aurophenine O.

Dianil Orange N.

Dianil Red R, 4B, 10B, Dianil Claret Red G, B, Delta Purpurine 5B.

Dianil Blue BX pat., Dianil Indigo O pat.

Dianil Black N, E, pat.

Dianil Brown 3GO, 3R, Dianil Copper Brown O.

## 3. Dianil Colours which dye the cotton deeper than the wool in a Glauber's salt bath.

Dianil Orange G pat.

Dianil Brown R, BD, G, B, D, M, Dianil Fastbrown B.

Dianil Blue G, B, R, 2R, 3R, 4R pat.

Dianil Darkblue R, 3R, pat.

Dianil Black PR, PG, CR, HW, pat.

Dianil New Black LBI pat.

## 4. Dianil Colours which dye the wool deeper than the cotton in a Glauber's salt bath.

Dianil Yellow G, Cresotine Yellow G.

Toluylene Orange R.

Dianil Scarlet G, 2R, pat.

Brilliant Dianil Red R, R conc.

Dianil Black T pat.

Dianil Green G pat.

## 5. Dianil Colours, which dye wool a different shade from cotton in a Glauber's salt bath.

Dianil Brown 5G.

Dianil Japonine G.

Dianil Blue E, ET, pat.

Dianil Black AC, CB, R, RN extra pat.



## 6. Wool Colours, which dye in a neutral Glauber's salt bath and are suitable for shading off the wool.

Alkaline Blue, all brands.

Acid Violet 5 BF, 5 BFI, 7 BN, N, Neutral Violet O.

Fast Acid Violet A 2 R, R, B, pat., Fast Acid Blue R, R  
conc., pat., Acid Rosamine A pat.

Rosazeine O, B, extra, B extra, pat.

Patentblue A pat.

Naphthalene Green V, conc., pat.

Fastblue, all brands.

Victoria Yellow O, double, conc., Azo Yellow O, conc.

Orange No. 4, No. 2.

Fastred O.

Scarlet B extra.

Blue for Halfwool B pat.

Amidonaphthol Black 4 B, 4 B extra, 6 B, S.

Chrome Black B, T, pat.

Acid Alizarine Grey G pat.

Acid Alizarine Brown B.

## Directions for dyeing union fabrics in a Glauber's salt bath:

A concentrated dyebath is prepared with 50% Glauber's salt and the required amount of dyestuff. The well wetted material is entered at 122° F and the temperature raised to nearly boiling point. At this temperature the cotton is dyed to pattern; then the shading off colours which might be required for the wool, are added and the latter dyed to pattern — eventually heating the bath to the boil.

## 7. Janus Colours which dye wool and cotton alike.

Janus Yellow G, R, pat.

Janus Red B pat.

Janus Brown R pat.

Janus Green G pat.

Janus Black O, I, pat.

## 8. Janus Colours which dye cotton deeper than wool.

Janus Brown B pat.

Janus Grey B, BB pat.

## 9. Janus Colours, which dye wool deeper than cotton.

Janus Green B pat.  
Janus Blue R, G pat.

## 10. Basic and Acid Colours which may be used together with Janus Colours for shading off purposes.

Rosazeïne O, B, extra, B extra, pat.  
Victoria Blue B.  
Methyl Violet 170, 2B, 6B chem. pure.  
Brilliant Green cryst. extra.  
Malachite Green cryst. extra.  
Patentblue V pat., Cyanine B pat.  
Flavazine T pat.

## Directions for dyeing union fabrics with Janus Colours in an acid bath:

A concentrated dyebath is prepared for **dark shades** with about 2% Sulphuric Acid and the solution of the required dyestuffs. The goods are entered at 140° F and dyed to shade after raising the temperature to nearly boiling point. Through violent boiling the wool is dyed deeper, while a lower temperature favours the cotton more.

For **light shades** the bath is prepared with 3—4% Hydrochloric Acid, 2% Fluoride of Chrome and the requisite dyestuff solutions. The material is entered at nearly boiling point and dyed to pattern at the boil. In case the wool turns out too light a small addition of Glauber's salt is made.

## 11. Janus Colours which are suitable for dyeing the cotton in previously Acid dyed union fabrics.

Janus Yellow G pat.  
Janus Brown R, B pat.  
Janus Red B pat.  
Janus Blue G, R, pat.  
Janus Green G, B, pat.  
Janus Grey B, BB, pat.  
Janus Black I, II, O, pat.

## Directions for dyeing the cotton cold in acid dyed union goods with Janus Colours.

The concentrated bath is prepared cold with 4% Muriatic Acid and the dyestuff solutions. The well rinsed material is entered and worked for 15 min., then double or treble as much Tannin as dyestuff is added and the goods worked for another  $\frac{1}{4}$  h. In order to fix the colours perfectly (for light shades) half as much Tartar Emetic as Tannin is added to the dyebath or (for dark shades) added to the rinsing bath.

## 12. Colours, which dye the cotton at a low temperature only slightly tinting wool.

Dianil Black PR, PG, R, CR pat.  
 Dianil Blue G, B, R, pat.  
 Dianil Yellow 2R pat., Dianil Orange G pat.  
 Dianil Brown R.  
 Melanogen Blue B pat.  
 Melanogen G, T, pat.  
 Thiogene Brown R pat.

## 13. Basic Colours which are suitable for shading off cotton in union fabrics on a tannin mordant.

Auramine conc., O, I, II, pat.  
 Azo Phosphine GO pat.  
 Chrysoïdine A cryst., C cryst., C extra cryst., Vesuvine, all brands.  
 Magenta, all brands, New Magenta O pat.  
 Methyl Violet, all brands.  
 Malachite Green, all brands, Brilliant Green, all brands.  
 Methylene Green O, extra yellow, extra yellow conc., G, 2G, 3G.  
 Methylene Blue, all brands.  
 Thionine Blue GO, Marine Blue BI, RI, 2R.  
 Methylene Heliotrope O, Methylene Violet RRA, BN, RRA conc., 3RA extra.  
 Methylene Grey NF, O.  
 Safranine, all brands.  
 Rosazeïne O, B, extra, B extra, 4G, 4G extra, pat.

## E. HALF SILK DYEING.

(Cotton and Silk fabrics.)

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The dyebath is prepared with

2 parts Olive Oil Soap  
0,2 parts Soda  
5 parts Common Salt

and the requisite amounts of dyestuff per 1000 parts.

The goods are entered at 122—140° F, then the temperature raised to nearly boiling point and the dyeing process finished in  $\frac{3}{4}$  h. Then the goods are rinsed and either (lusted) brightened with a little Acetic or Muriatic Acid, or, in case it is necessary to top the colours, topped at 122—140° F in a bath which is acidified with Acetic or Muriatic Acid, and finally lusted.

### 1. Dyestuffs which dye cotton and silk alike.

Aurophenine O.  
Cresotine Yellow G.  
Dianil Brown 3GO.  
Janus Yellow R, G, pat.  
Janus Brown R pat.  
Janus Red B pat.

### 2. Dyestuffs, which dye cotton deeper than silk.

Dianil Yellow 2R, 3G, pat.  
Dianil Orange N, Toluylenorange R.  
Deltapurpurine 5B, Brilliant Dianil Red R.  
Dianil Red R, 4B, 10B.  
Dianil Blue 2R, 4R, pat.  
Dianil Brown G, B, BD, M, R, D, Dianil Fastbrown B.  
Dianil Darkblue 3R pat.  
Dianil Black CR pat.

### 3. Dyestuffs which dye silk deeper than cotton.

Dianil Yellow G, R pat.

#### 4. Dyestuffs, which dye cotton almost exclusively.

Dianil Direct Yellow S.  
 Oxydianil Yellow O.  
 Dianil Orange G pat.  
 Dianil Blue G, B, R, pat.  
 Dianil Darkblue R pat.

#### 5. Dyestuffs which dye silk, leaving cotton white.

Acid Magenta extra, Acid Maroon O.  
 Acid Violet 3RS.  
 Acid Green conc.  
 Patentblue V pat., Keton Blue 4BN solution, 4BN powder, pat.  
 Naphthol Yellow S.  
 Flavazine S, T.  
 Azo Yellow conc., Orange No. 2.  
 Scarlet R, 6R.  
 Victoria Rubine O, Fastred S.

#### 6. Dyestuffs which are suitable for topping.

##### a) For silk.

Acid Magenta extra, Acid Maroon O, Acid Cerise O.  
 Acid Violet, all brands.  
 Methyl Blue for Silk MLB, for Cotton MLB.  
 Opalblue blue shade, superior sol.  
 Blue for Silk T, T conc., greenish, No. 99, KR.  
 Acid Green conc  
 Patentblue A, V, pat.  
 Keton Blue 4BN sol., 4BN powder, pat.  
 Violamine, all brands, pat.  
 Fastblue, all brands, Blackblue O, Black Black O, Fast-darkblue R.  
 Nigrosine No. 1-4.  
 Chinoline Yellow O, conc.  
 Naphthol Yellow S.  
 Flavazine S, T.  
 Azo Yellow conc.  
 Orange G, No. 2, Brilliant Orange O, G, R.  
 Fastbrown O, yellow shade.  
 Scarlet G, R, 6R, B extra, Scarlet 6R cryst.  
 Rosazaine, all brands.

Diamond Scarlet for Silk G, Scarlet for Silk O, G, 2G.  
Brilliant Croceïne yellow and blue shade, R, B, BB, 3B, 5B,  
Fastred O, S, Brilliant Crimson O.  
Amaranth O.  
Amido Naphthol Black 4B, 4B extra, 6B, S.

b) For cotton.

Auramine O, conc., pat.  
Phosphine new.  
Chrysoidine A cryst., C cryst., C extra cryst.  
Vesuvine conc., 3R superior, 4BG conc., extra yellow.  
Magenta, large cryst., small cryst., Cerise G, Grenadine O,  
Cardinal R, Maroon O, New Magenta O pat.  
Methyl Violet, all brands, Violet crystals O, Primula R, B.  
Brilliant Green cryst. extra, Malachite Green cryst. extra.  
Safranine conc., Methylene Violet 2RA, 2RN, BN.  
Methylene Blue BB extra, BB conc., BB, R, 6R.  
Methylene Green O, G, GG, 3G, extra yellow, extra yellow conc.  
Methylene Grey O, NF.  
Rosazeïne O, B, extra, B extra, 4G, 4G extra, pat.

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## F. FABRICS OF WOOL AND SILK.

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### 1. Acid Colours which dye wool almost exclusively.

The dyebath is prepared with about 10% Acetic Acid and the required dyestuff solutions. The goods are entered at nearly boiling point and dyed for 1—1½ h at the boil. For very dark shades 1% of Sulphuric Acid may be added in order to exhaust the bath. The shades ought to be dyed a little fuller (deeper) than the pattern in order to allow for the cleansing process. The cleansing bath contains per 1000 Gall of liquid 1 Gall of Acetate of Ammonia. The goods are worked for about 20 min., until the silk effects appear sufficiently clean. In many instances it is sufficient to clean the silk in a bath containing water of 140° F. only.

**Acid Magenta**, all brands, **Acid Violet** 3RS, 4RS.

**Azo Acid Carmine** B pat., **Alkaline Fastred** R pat.

**Chromotrope** 2R, 2B, 6B, 8B, 10B, pat.

**Victoria Violet** 4BS, 8BS, pat., **Azo Acid Blue** B pat.

**Naphthol Yellow S**,

**Flavazine T**.

**Orange G**.

**Scarlet** 6R, **Scarlet** 6R crystals.

**Victoria Rubine** O, **Naphthol Red** O.

**Victoria Scarlet** 3R, 4R, 5R, 6R.

**New Coccine** O, **Amaranth** O, E.

### 2. Chrome developing Colours, which scarcely tint the silk.

The dyebath is prepared with 10% Acetic Acid, 10% Glauber's salt and the requisite amounts of dyestuff. The goods are entered at nearly boiling heat and boiled for 1 h. Then 3% Bichrome (for Acid Alizarine Blue BB 3% Fluoride of Chrome) are added and the shade developed by boiling for another ¾ h. The silk effects are cleansed in the manner described in No. 1 or the goods are soaped, after rinsing, in a hot bath containing 2 parts soap per 1000 parts.

**Chromotrope** 6B, 8B, 10B, FB, F4B, pat.

**Acid Alizarine Blue** BB pat.

### 3. Dianil Colours which dye wool and silk alike in a neutral Glauber's salt bath.

The dyebath is prepared for dark shades with about 30% Glauber's salt, for light shades with about 10% Glauber's salt and the goods dyed at the boil. If the silk is dyed too light, the bath is cooled down a little and the material worked for some time at the lower temperature, or some more dyestuff is added, which will be mainly taken up by the silk.

Dianil Yellow 3G, R, 2R pat, Dianil Orange G pat.

Dianil Brown 3GO, R, BD.

Dianil Claret Red G, B, Dianil Red 4B.

Dianil Blue G, B, R, 2R, 3R, 4R pat.

Dianil Black CR, N, R, E, pat.

### 4. Colours which dye wool and silk in an Acid bath alike or nearly alike.

The dyebath is prepared with 4% Sulphuric Acid and 10% Glauber's salt and the requisite amounts of dyestuff. The goods are entered hot and the wool dyed to pattern at the boil. Then the steam is turned off and the silk dyed exactly to pattern with basic colours as stated in No. 5. If the wool is kept decidedly lighter than the pattern, then the bath may be cooled down to 140° F and the silk be dyed to shade with dyestuffs as stated in No. 4, which will be mainly taken up by the silk at a lower temperature.

The Resorcline Colours are not dyed with Glauber's salt and Sulphuric Acid but with 10% Acetic Acid.-Alkaline Blues are dyed with Borax and Soap or with Sodium Phosphate and Soap, then rinsed and, in a fresh bath, soured off with Sulphuric Acid.

Eosine, all brands, Erythrosine, all brands, Phloxine, all brands, Rose Bengale, all brands.

Rosazeïne O, B extra, B extra pat.

Acid Rosamine A pat., Fast Acid Violet A2R, R, B, pat., Fast Acid Blue R, R conc., pat., Opal Blue, all brands, Blue for Silk, all brands.

Acid Violet N, 5BF, 5BFI, 7BN.

Alkaline Blue, Bleu de Lyon, Soluble Blue, all brands.

Patent Blue V, N, superior, L, LL, B, G conc., A, pat.

Fastblue, all brands, Fast Darkblue, R.

Azo Yellow O, conc.

Victoria Yellow O, double conc.

Orange No. 2, 4, 4LL, RR.

Scarlet M new, B extra.

Brilliant Croceïne, all brands, Fastred O.

### 5. Basic Colours which dye the silk in wool and silk fabrics in an Acid bath.

Chrysoïdine A cryst., C cryst., C extra cryst., Vesuvine, all brands.



Azo Phosphine GO pat.  
 Magenta, all brands, New Magenta O pat.  
 Methyl Violet, all brands.  
 Brilliant Green, all brands, Malachite Green, all brands.  
 Methylene Blue, all brands.  
 Methylene Green, all brands.  
 Safranine, all brands, Methylene Violet 2RA, 3RA, BN,  
 Methylene Heliotrope O.

## 6. Colours which dye silk in a cold Acid bath without noticeably staining wool.

Auramine O, I, II, conc., pat.  
 Janus Yellow G, R, pat.  
 Janus Brown R, B, pat.  
 Janus Red B pat.  
 Janus Blue G, R, pat., Janus Green G, B, pat.  
 Janus Grey B, 2B, Janus Black O, I, II, pat.  
 Safranine, all brands, Methylene Violet 2RA, 3RA, Methylene Heliotrope O.  
 Rosolane O, T.  
 Methylene Blue, all brands, Methylene Green extra yellow.  
 Rosazeïne O, B, extra, B extra, 4G, 4G extra, pat.  
 Fast Acid Eosine G pat., Fast Acid Phloxine A pat., Fast Acid Magenta G pat., Violamine G, A2R, R, B, 3B, pat.  
 Acid Magenta, all brands, Acid Violet 3RS, 4RS, 7BN.  
 Naphthalene Green V, conc., pat.  
 Methyl Blue for Cotton MLB, Pure Blue, all brands, Blue for Silk, all brands.  
 Brilliant Croceïne, all brands.  
 Scarlet 5R.  
 Victoria Rubine O, Naphthol Red O, Amaranth O, E.

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## G. JUTE (COCOA-NUT FIBRE, PIASSAVA).

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### 1. Colours which dye Jute in a neutral bath.

The Jute is cleansed before dyeing with Soda and if necessary bleached in a bath containing Sodium Hypochlorite of 4° Tw.

The Jute is dyed at 185–194° F in a neutral bath or with an addition of Alum or Common Salt.

**Auramine** conc., O, I, II.

**Chrysoïdine** A cryst., C cryst., C extra cryst., **Vesuvine** 4BG conc., 3R superior.

**Phosphine** extra, O, **Yellow for Leather** O, G, GG.

**Azo Phosphine** GO, BRO, pat.

**Red for Leather** O, R, G, **Brown for Leather** O, **Saffian** Red O, **Piassava Brown** O.

**Magenta** large cryst., small cryst., **Cerise** G, R, **Grenadine** O, R, RR, **Russia Red** D, 5001, **Maroon** O, extra, **Cardinal** R, G.

**New Magenta** O pat.

**Safranine** O, conc., **Scarlet for Cotton** O.

**Fastred** O.

**Methyl Violet**, all brands.

**Malachite Green** cryst. extra, **Brilliant Green** cryst. extra.

**Methylene Blue**, all brands, **Methylene Green**, all brands.

**Indamine Blue** N extra, NB.

**Fast New Blue** 3R cryst., **Fastblue for Cotton** R, BB, 4B.

**Coalblack** I, II, III.

**Janus Yellow** G, R, pat.

**Janus Red** B pat.

**Janus Brown** R pat.

**Janus Blue** G, B, R, pat., **Janus Green** G, B, pat.

**Janus Black** O, I, II, pat.

### 2. Colours, which dye Jute in an Alum bath.

**Cotton Lightblue** O, **Pure Blue** conc., **Conc. Cotton Blue** No. 1, No. 2, R, **Blue for Linen and Jute**.

**Azo Yellow** conc.

**Orange** G, **Brilliant Orange** G, O, R.

**Fast Blue O**, R, 5B, **Black Blue O**, **Black Black O**, **Nigrosine No. 1**, 2, 3, 4, **Black for Feathers**.

**Azo Yellow** conc.

**Victoria Yellow** conc.

**Orange No. 2**, No. 4, G, **Brilliant Orange G**, O, R.

**Fast Brown O**. yellow shade.

**Scarlet G**, R, RR, 3R, 4R, 5R, 6R, B extra.

**Brilliant Croceine** yellow and blue shades, R, B, BB, 3B, 5B.

**Fast Red O**, **Claret Red G**, B, R.

**Amido Naphthol Black 4B**, 4B extra, 6B, S.

### 3. Colours which dye in an Acetic Acid bath.

**Rosolane O**, BO, T.

**Rosazeine O**, 4G pat.

**Eosine extra AG**, extra BB.

**Erythrosine** yellow shade, blue shade, yellow shade N, blue shade N.

**Phloxine G**, O, 2B, 5B.

**Rose Bengale G**, B.

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## K. DYEING OF ARTIFICIAL FLOWERS.

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### 1. Colours which dye in a neutral bath.

The flowers are dyed in a neutral or slightly acidified bath at the boil and then before being perfectly dried rubbed with Oil or Glycerine.

Auramine conc., O, I, II.

Chrysoïdine A cryst., C. cryst., C extra cryst., Vesuvine 4BG conc., 3 R superior.

Phosphine extra, O, Yellow for Leather O, G, GG.

Azophosphine GO, BRO, pat.

Red for Leather O, R, G, Brown for Leather O.

Magenta large cryst., small cryst., Cerise G, R, Grenadine O, R, RR, Russia Red D, 5001, Maroon O, extra, Cardinal R, G.

New Magenta O pat.

Safranine O, conc., Methylene Violet 3RA extra, RRA, BN.

Methyl Violet, all brands.

Malachite Green cryst. extra, Brilliant Green cryst extra.

Methylene Blue, all brands, Methylene Green, all brands.

New Fast Blue 3R cryst., Fastblue for Cotton R, BB, 4B.

Coalblack II.

Janus Yellow G, R, pat.

Janus Red B pat.

Janus Brown R pat.

Janus Blue G, B, R, pat., Janus Green G, B, pat.

Janus Black O, I, II, pat.

### 2. Colours which dye in an Acetic Acid bath.

Rosolane O, BO, T.

Rosazeïne O, 4G pat.

Eosine extra AG, extra BB.

Erythrosine yellow shade, blue shade, yellow shade N, blue shade N.

Phloxine G, O, 2B, 5B.

Rose Bengale G, B.

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## L. BUTTONS OF VEGETABLE IVORY.

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Before dyeing the buttons are boiled for 1—2 h in water. They are dyed for 1—2 h at the boil in a neutral bath. For dark shades it is necessary to mordant the buttons with Tannin and Tartar Emetic.

**Auramine** conc., O, I, II, pat.

**Chrysoïdine** A cryst., C cryst., C extra cryst., **Vesuvine** 4BG conc., 3R superior.

**Phosphine** extra, O, **Yellow for Leather** O, G, R, **Brown for Leather** O.

**Magenta** large cryst., small cryst., **Cerise** G, R, **Grenadine** O, R, RR.

**Maroon** O, extra, **Cardinal** G, R.

**New Magenta** O pat.

**Safranine** conc., O, **Methylene Violet** 3RA extra, RRA, BN.

**Malachite Green** cryst. extra, **Brilliant Green** cryst. extra.

**Methyl Violet** 2B chemic. pure, 6B chemic. pure.

**Methylene Blue**, all brands, **Methylene Green**, all brands.

**New Fast Blue** 3R cryst., **Fastblue for Cotton** R, BB, 4B.

**Methylene Grey** O, NF.

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# M. DYEING OF LEATHER.

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## 1. Colours which dye tanned leather in a neutral bath.

The tanned hides in lots of two for each dyeing, are steeped for 5–10 min. into a neutral or slightly acidified bath of 104–115° F or the colour solutions (115° F warm) are brushed on to the hides.

Auramine conc., O, I, II, pat.

Chrysoïdine A cryst., C cryst., C extra cryst., Vesuvine 4 BG conc., 3 R superior.

Phosphine extra, O, P, superior, Yellow for Leather O, G, GG, Red for Leather O, R, G, Brown for Leather O, Brown A, Saffian Red O.

Azo Phosphine GO, BRO, pat.

Magenta large cryst., small cryst., Cerise G, R, Grenadine O, R, RR, Russia Red D, 5001, Maroon O, extra, Cardinal G, R.

New Magenta O pat.

Safranine conc., O.

Methyl Violet 2 B chemic. pure, 6 B chemic. pure.

Malachite Green cryst. extra, Brilliant Green cryst. extra.

Methylene Blue, all brands, Methylene Green, all brands.

New Fast Blue 3 R cryst., Fastblue for cotton R, BB, 4 B.

Methylene Grey O. NF.

Janus Yellow G, R, pat.

Janus Red B pat.

Janus Brown R pat.

Janus Blue B pat., Janus Green G pat.

Janus Black I.

Leather Black T, TM, 5068.

## 2. Colours which dye tanned leather in a weak Sulphuric Acid bath.

Acid Magenta extra, Orseilline R, B, Acid Cerise O, Acid Maroon O.

Bleu de Lyon RR, Pure Blue O conc., Conc. Cotton Blue No. 2, China Blue No. 2.

Acid Green conc.

Patentblue V, A, pat.

Fastblue O, R, 5B, Nigrosine No. 1, 2, 3, 4, O spirit.

Azo Yellow conc., Victoria Yellow conc.  
 Orange No. 2, No. 4, G, Brilliant Orange G, O, R.  
 Solid Brown O, yellow shade.  
 Scarlet G, R, RR, 3R, 4R, 5R, 6R, B extra.  
 Brilliant Croceine yellow shade, blue shade, R, B, 2B, 3B, 5B.  
 Fastred O, Claret Red G, R, B.

### 3. Colours which dye tanned leather in a weak Acetic Acid bath.

Eosine extra AG, extra BB.  
 Phloxine O, G, 5B.  
 Red Y, YB.  
 Rosazeine O, 4G pat.

### 4. Colours which dye alum-prepared leather in a neutral bath.

The alum-prepared hides are dyed at 115° F in lots of two, after removing the superfluous Alum by rinsing; or the colours are brushed on (Colour solutions of 115° F).

Auramine conc., O, I, II, pat.  
 Chrysoïdine A cryst., C cryst., C extra cryst., Vesuvine 4BG conc., 3R superior.  
 Phosphine extra, O, P, superior, Yellow for Leather O, G, GG, Red for Leather O, R, G, Brown for Leather O, Brown A, Saffian Red O.  
 Azophosphine GO, BRO, pat.  
 Magenta large cryst., small cryst., Cerise G, R, Grenadine O, R, RR, Russia Red D, 5001, Maroon O, extra, Cardinal R, G.  
 New Magenta O pat.  
 Safranine conc., O.  
 Methyl Violet 2B chemic. pure, 6B chemic. pure.  
 Malachite Green cryst. extra, Brilliant Green cryst extra.  
 Methylene Blue and Methylene Green, all brands.  
 New Fast Blue 3R cryst., Fast Blue for Cotton R, BB, 4B.  
 Methylene Grey O, NF.  
 Janus Yellow G, R, pat.  
 Janus Red B pat.  
 Janus Brown R pat.  
 Janus Blue B pat., Janus Green G pat.  
 Janus Black I pat.  
 Leather Black T, TM, 5068.

### 5. Colours which dye alum-prepared leather in a weak Sulphuric Acid bath.

Acid Magenta extra, Orseilline R, B, Acid Cerise O, Acid Maroon O.

Bleu de Lyon RR, Pure Blue O, conc., Conc. Cotton Blue  
 No. 2, China Blue No. 2.  
 Acid Green conc.  
 Patentblue V, A, pat.  
 Fastblue O, R, 5B, Nigrosine No. 1, 2, 3, 4, O spirit.  
 Azo Yellow conc., Victoria Yellow conc.  
 Orange No. 2, No. 4, G, Brilliant Orange G, O, R.  
 Solid Brown O, yellow shade.  
 Scarlet G, R, RR, 3R, 4R, 5R, 6R, B extra.  
 Brilliant Croceine yellow shade, blue shade, R, B, 2B, 3B, 5B.  
 Fastred O, Claret Red G, R, B.

## 6. Colours which dye alum-prepared leather in a weak Acetic Acid bath.

Eosine extra AG, extra BB.  
 Phloxine O, G, 5B.  
 Red Y, YB.  
 Rosazeine O, 4G pat.

## 7. Colours which dye chromed leather in a weak Acetic Acid bath.

Chromed hides are best dyed in drums at 158–176° F for  
 about  $\frac{1}{2}$  h.  
 Acid Magenta extra, Orseilline R, B, Acid Cerise O, Acid  
 Maroon O.  
 Bleu de Lyon RR, Pure Blue O conc., Conc. Cotton Blue  
 No. 2, China Blue No. 2.  
 Acid Green conc.  
 Patentblue V, A, pat.  
 Fastblue O, R, 5B, Nigrosine No. 1, 2, 3, 4, O spirit.  
 Azo Yellow conc., Victoria Yellow conc.  
 Orange No. 2, No. 4, G, Brilliant Orange G, O, R.  
 Solid Brown O, yellow shade.  
 Scarlet G, R, RR, 3R, 4R, 5R, 6R, B extra.  
 Brilliant Croceine yellow shade, blue shade, R, B, 2B, 3B, 5B.  
 Fastred O, Claret Red G, R, B.

## 8. Colours which dye chromed leather in a weak Acetic Acid bath.

Eosine extra AG, extra BB.  
 Phloxine O, G, 5B.  
 Red Y, YB.  
 Rosazeine O, 4G pat.



## 9. Colours which dye Chromed leather in an alkaline or in an ordinary salt bath.

Dianil Yellow 3G, R, 2R, pat.  
 Dianil Orange G pat.  
 Dianil Brown R.  
 Dianil Blue G, B, pat.  
 Chrome Leather Brown No. 1-4.  
 Leather Black C, E, pat.

## 10. Colours which dye Chromed leather in a neutral bath.

When using the colours stated below, it is necessary to pass the chromed hides through a weak Sumach solution for 10-15 min. at 104-113° F before dyeing.

Auramine conc., O, I, II, pat.  
 Chrysoidine A cryst., C cryst, C extra cryst., Vesuvine 4BG conc., 3R superior.  
 Phosphine extra, O, P, superior, Yellow for Leather O, G, GG.  
 Azophosphine GO, BRO, pat.  
 Red for Leather O, G, R. Brown for Leather O, Brown A, Saffian Red O.  
 Magenta small cryst., large cryst., Cerise G, R, Grenadine O, R, RR, Maroon O, extra, Cardinal G, R. Russia Red D, 5001.  
 New Magenta O pat.  
 Safranine conc., O.  
 Methyl Violet 2B, 6B chem. pure.  
 Malachite Green cryst. extra, Brilliant Green cryst. extra.  
 Methylene Blue, all brands, Methylene Green, all brands.  
 New Fast Blue 3R cryst., Fastblue for Cotton R, BB, 4B.  
 Janus Yellow G, R, pat.  
 Janus Brown R pat.  
 Janus Red B pat.  
 Janus Blue B pat., Janus Green G pat.  
 Janus Black I pat.  
 Leather Black T, TM, 5068.

# N. COLOURS SUITABLE FOR LAKE AND PIGMENT MANU- FACTURING.

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## 1. Colours which are precipitated with Barium Chloride.

Directions: 10 lbs Alum,  $2\frac{1}{2}$  lbs Soda calc., about 2 lbs Colour,  $10\frac{1}{2}$ —13 lbs Barium Chloride.

Fast Acid Violet A 2R, R, B, pat., Fast Acid Magenta G pat.  
Acid Violet N, 5BF.

Alkaline Blue, all brands, Methyl Alkaline Blue MLB, Alkaline Violet O.

Opalblue, red shade, blue shade, green shade, extra green shade,  
Blue, blueish, red shade, Purple Blue O, Cloth Blue O,  
Full Blue O, China Blue R, No. 1, 2, Guernsey Blue O,  
Soluble Blue, all brands, Bleu de Lyon, all brands, Laundry  
Blue O, Navy Blue V.

Conc. Cotton Blue, all brands, Pure Blue, all brands, Opal  
Blue superior, Cotton Blue extra, OO. Methyl Blue for  
Cotton MLB, Cotton Light Blue O, sol.

Acid Green, all brands.

Patent Blue pat., all brands, Keton Blue 4BN powder, 4BN  
solution, pat., Patent Green V, O, pat.

Naphthalene Green V, conc. pat.

Fastblue, all brands, Nigrosine No. 1, 2, 3, 4.

Naphthol Yellow S, SL, SE.

Azo Yellow conc., O, R, Victoria Yellow O, double, conc.

Orange O, No. 2, No. 4, LL, RRL, Brilliant Orange G, O, R,  
Fast Orange O.

Scarlet, all brands, Scarlet 6R cryst., Brilliant Lake Scarlet  
G, R, 2R, Lake Red P.

Paper Scarlet, all brands.

Brilliant Crimson O, Clothred O, Fastred O, Claret Red G,  
O, R, Solid Brown L, yellow shade.

Acid Alizarine Blue BB pat.

Dianil Yellow 3G, G, R, 2R, pat., Dianil Orange G pat.

Dianil Red 4B, Dianil Claret Red G, B.

Dianil Scarlet G, 2R, pat.

Dianil Brown, all brands.

Dianil Blue G, B, R, pat.

Dianil Black pat., all brands.

## 2. Colours which are precipitated with lead-salts.

Directions: 30 lbs Alumina Hydrate, 20 lbs Barytes, about 1½ lbs Colour, 1 lb Nitrate of lead.

All colours mentioned under 1; also:

Uranine O, N.  
Eosine, all brands.  
Erythrosine, all brands.  
Phloxine, all brands.  
Rose Bengale G, B.

## 3. Colours which are precipitated with Solidogen.

Directions: 10 lbs Alumina Hydrate, ½ lbs Colour, ¼ lbs Solidogen A pat.

All colours mentioned under 1 and 2.

## 4. Colours which are precipitated with Tannin or Tannin-Tartar Emetic.

Auramine conc., O, I, II, pat.  
Chrysoïdine A cryst., C cryst., C extra cryst., Vesuvine, all brands, Cutch Brown D, G, Darkbrown M, MB, Phosphine extra, new, P, superior.  
Magenta, all brands, Acetate of Magenta, Cerise G, R, Grenadine O, R, RR, Maroon O, extra.  
New Magenta O, P, pat.  
Methyl Violet, all brands, Peacock Blue P.  
Malachite Green, all brands. Brilliant Green, all brands.  
Victoria Blue B.  
Rosazeïne O, B, extra, B extra, pat.  
Safranine conc., conc. B, G, GS.  
Methylene Blue, all brands.  
Coalblack O, I, II.

## 5. Colours which are precipitated direct upon silicates (Green earth, Clay, Ochre).

Directions: 50 lbs green earth, about 1 lb Colour.

Auramine conc., O, I, II, pat.  
Chrysoïdine A cryst., C cryst., C extra cryst., Vesuvine, all brands, Cutch Brown D, G, Darkbrown M, MB, Phosphine extra, new, P, superior.

**Magenta**, all brands, **Acetate of Magenta**, **Cerise G, R, Grenadine O, R, RR, Maroon O**, extra.  
**New Magenta O, P**, pat.  
**Methyl Violet**, all brands, **Peacock Blue P**.  
**Malachite Green**, all brands, **Brilliant Green**, all brands.  
**Victoria Blue B**.  
**Rosazeïne O, B**, extra, **B extra**, pat.  
**Safranine conc.**, conc. **B, G, GS**.  
**Methylene Blue**, all brands.  
**Coalblack O, I, II**.

## 6. Colours which are precipitated upon Alumina substrate.

### a) Rosaniline Dyestuffs.

Directions: 80 lbs Alumina hydrate, 20 lbs Blanc Fixe, about 2 lbs Colour.

**Alkaline Blue**, all brands, **Methyl Alkaline Blue MLB, Alkaline Violet O**.  
**Opal Blue** red shade, blue shade, green shade, extra green shade, Blue red shade, blueish, **Purple Blue O, China Blue R, No. 1, No. 2, Guernseyblue O, Soluble Blue**, all brands, **Bleu de Lyon**, all brands, **Pure Blue**, all brands.

### b) Alizarine Colours.

Directions: 75 lbs Phosphate of soda, 20 lbs soda calc., about 35 lbs Alizarine paste, 10 lbs Turkey Red Oil, 5 lbs Acetate of lime.

**Alizarine 1B new, 2A bl. bl., RX, SDG, 5F**.  
**Alizarine Orange N**.  
**Alizarine Brown**, all brands.  
**Ceruleïne paste A, Galleïne paste R**.

### c) Azarine.

Directions:  $8\frac{1}{4}$  lbs Phosphate of soda,  $5\frac{1}{4}$  lbs Soda calc., 5 lbs Turkey Red Oil, 2 lbs Stannate of soda, 25 lbs Alum, about 1 lb Azarine S.

**Azarine S**.

## 7. Colours produced during the precipitation.

Directions: 100 parts  $\beta$ -Naphthol solution,  $2\frac{1}{2}$  parts Phosphate of soda, 100 parts Diazo- or Azophor-solution.

$\beta$ -Naphthol-solution:  $1\frac{1}{2}$  parts  $\beta$ -Naphthol, 3 parts Soda lye  $33^\circ$  Tw., made up to 100 parts.

1 Diazo-solution: 1.4 parts Paranitraniline, 12 parts Water, 0.754 parts Sodium nitrite, cooled with ice to 39° F. Then, whilst stirring, add 2.2 parts Hydrochloric acid 36° Tw. After allowing to settle, the solution is filtered and made up to 100 parts.

Azophor-solution: 5.6 parts Azophor Red PN pat., 50 parts Water; solution after allowing to stand for  $\frac{1}{2}$ —1 h, is filtered; remaining particles are dissolved in more water and the whole made up to 100 parts.

$\beta$ -Naphthol,  $\beta$ -Naphthol R,  $\beta$ -Naphthol RL, developed with: Paranitraniline extra, Meta Nitraniline, Nitrotoluidine, Nitrophenetidine, o-Anisidine.

Amidoazobenzol, Amidoazotoluol.

$\alpha$ -Naphthylamine, Naphthylamine salt S,  $\beta$ -Naphthylamine.

Benzidine Base, Tolidine Base, Dianisidine Base.

Azophor Red PN, AB pat.

Azophor Orange MN pat.

## O. PAPER DYEING.

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### a) The dyeing of paper in pulp.

After having worked the material for some time in the pulping machine, the very diluted colour-solutions are added (likewise fixing ingredients if required). Sulphate of Alumina or Alum, which are used for precipitating resin-soap, are also the fixing agents for the dyestuffs. It is advisable not to add these in excess to the pulp viz not to produce a too acid reaction. If colours of different series are used for dyeing — which often happens — care must be taken to have the colour of the one series properly and evenly worked in, before adding a colour of a second series.

Colours, which are suitable for dyeing paper pulp:

#### Basic Colours.

**Auramine** conc., O, I, II, pat.

**Chrysoïdine** A cryst., C cryst., C extra cryst.. **Vesuvine**, all brands, **Cutch Brown**, all brands, **Dark Brown**, all brands, **Phosphine** extra, new, P, superior.

**Magenta**, all brands, **Acetate of Magenta**, **Cerise** G, R, extra conc., **Maroon** O, extra, **New Magenta** O, P, pat.

**Methyl Violet**, all brands, **Brilliant Green**, all brands, **Malachite-Green**, all brands, **Peacock Blue** P.

**Coalblack** O, I, II.

**Methylene Blue**, all brands.

**Victoria Blue** B.

**Safranine** O, conc., AN extra, GGS, conc., B, GO.

**Rosazeïne** O, B, OG, extra, B extra, G extra, 4G extra, pat.

**Janus Yellow** G, R, pat.

**Janus Red** B, pat.

**Janus Brown** R, B, pat.

**Janus Blue** R, G, pat., **Janus Green** B, G, pat., **Janus Grey** B, BB.

**Janus Black** O, I, II, pat.

#### Acid Colours.

**Uranine** O soluble, DO.

**Eosine**, all brands.

**Erythrosine**, all brands.

**Phloxine**, all brands.  
**Rose Bengale**, all brands.  
**Fast Acid Violet R, B, A2R**, pat.  
**Acid Violet**, all brands.  
**Alkaline Blue**, all brands, **Methyl Alkaline Blue MLB**, **Alkaline Violet O**.  
**Opal Blue** red shade, blue shade, green shade, **Blue** red shade, blueish, TB, 120RMA, Grb. V, **Purple Blue O**, **Cloth Blue O**, **China Blue R**, No. 1, No. 2, **Guernsey Blue O**, **Soluble Blue**, all brands, **Laundry Blue O**, **Full Blue O**, **Navy Blue V**, **Bleu de Lyon**, all brands.  
**Conc. Cotton Blue**, all brands, **Pure Blue O**, conc., double conc., double conc. R., **Opal Blue** superior soluble, **Cotton Lightblue O** soluble, **Cotton Blue extra**, OO, **Methyl Blue** for Cotton MLB.  
**Emperor Blue O**, **Paper Blue**, all brands.  
**Fast Pure Yellow CHO**, CH extra.  
**Naphthol Yellow S**, SL, SE, **Paper Yellow MT**.  
**Azo Yellow conc.**, O, R, **Victoria Yellow O**, double, conc., **Metanil Yellow extra**.  
**Orange**, all brands, **Brilliant Orange O**, G. R.  
**Scarlet G**, GRII, GVL, RRL, GRL 95, R, RR, 3R, 5R, **Paper Scarlet**, all brands, **Brilliant Croceïne 8B**.  
**Cloth Red O**, **Fastred O**, S.  
**Solid Brown O**, yellow NP, L.  
**Claret Red**, all brands.

### Direct dyeing Colours.

**Dianil Yellow 3G**, G, R, 2R, pat.  
**Oxydianil Yellow O**, **Paper Yellow O**.  
**Dianil Orange G**, R, pat., N.  
**Delta Purpurine 5B**, **Brilliant Dianil Red R**.  
**Dianil Red R**, 4B, 10B, **Dianil Claret Red G**, B.  
**Dianil Scarlet G**, 2R, pat.  
**Dianil Blue G**, B, R, 2R, 4R, BX, pat., **Dianil Darkblue R**, 3R, pat.  
**Dianil Brown**, all brands, **Dianil Fastbrown B**.  
**Dianil Black**, pat., all brands.  
**Dianil New Black LBI** pat.  
**Directblack II**.

### b) The dyeing of paper (ready made).

This operation is carried out in the following manner: The paper is passed first through the dyestuff-solution, then through several rollers in order to squeeze out all superfluous liquid and finally dried over hot cylinders.

For this process only colours of one series are suitable for mixed shades.

## Basic Colours.

Auramine conc., O, I, II, pat.  
 Phosphine extra, new, P, Vesuvine, all brands.  
 Magenta, all brands, Acetate of Magenta, Cerise extra conc.,  
     New Magenta O, P, pat.  
 Methyl Violet, all brands.  
 Brilliant Green, all brands, Malachite Green cryst. extra.  
 Coalblack O, I, II.  
 Methylene Blue, all brands.  
 Victoria Blue B.  
 Safranine O, conc., AN extra, GGS, conc. B, GO.  
 Rosazeine O, B, OG, extra, B extra, G, pat.  
 Janus Yellow R, G, pat.  
 Janus Brown B, R, pat.  
 Janus Red B pat.  
 Janus Blue R, G, pat., Janus Green B, G, pat.  
 Janus Grey B, BB, pat., Janus Black O, I, II, pat.

## Acid Colours.

Fast Pure Yellow CHO, CH extra.  
 Naphthol Yellow S, SL, SE, Paper Yellow MT, Victoria  
     Yellow O, double, conc.  
 Orange G, No. 2, 2L, No. 1, O, No. 64, R, RR, Brilliant  
     Orange O, G, R.  
 Scarlet, all brands, Scarlet 6 R cryst., Paper Scarlet, all brands,  
     Brilliant Croceine 8B.  
 Solidbrown O soluble, yellow shade, NF, L.  
 Claret Red, all brands.  
 Uranine O soluble, DO.  
 Eosine, all brands.  
 Erythrosine, all brands.  
 Phloxine, all brands.  
 Rose Bengale, all brands.  
 Fast Acid Eosine G pat., Fast Acid Phloxine A pat., Fast  
     Acid Magenta G pat.  
 Fast Acid Violet R, B, A2R, pat.  
 Acid Magenta O, extra, M.  
 Acid Violet, all brands.  
 Alkaline Blue, all brands, Methyl Alkaline Blue MLB, Al-  
     kaline Violet O, Blue red shade, blueish, TB, 120 RMA,  
     Purple Blue O, Cloth Blue O, China Blue R, No. 1,  
     No. 2, Guernsey Blue O, Soluble Blue, all brands, Bleu  
     de Lyon O, R, RR, Opal Blue red shade, blue shade, green  
     shade, Laundry Blue O, Full Blue O, Navy Blue V.  
 Conc. Cotton Blue RR, R, No. 1, No. 2, No. 2 double, Pure  
     Blue O, conc., double conc. R, Opal Blue sup. sol., Paper  
     Blue 8928, 8929, No. 30, Cotton Light Blue O, Cotton Blue  
     extra, OO, Methyl Blue for Cotton MLB, Emperor Blue O.  
 Acid Green, all brands.  
 Patentblue pat., all brands, Keton Blue 4 BN solution, 4 BN  
     powder, pat.  
 Patent Green O, V, VS, pat.  
 Fastblue, all brands, Nigrosine No. 1, 2, 3, 4, A, R.



## Direct dyeing colours.

Dianil Yellow 3G, G, R, 2R, pat.  
 Oxydianil Yellow O, Paper Yellow O.  
 Dianil Orange G, R, pat.  
 Dianil Red 4B, Dianil Claret Red G, B.  
 Dianil Scarlet G, 2R, pat.  
 Dianil Blue G, B, R, 2R, 4R, RX, pat., Dianil Darkblue R,  
 3R, pat.  
 Dianil Brown, all brands.  
 Dianil Black, pat., all brands.  
 Dianil New Black LBI pat.  
 Direct Black II.

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## c) Colours, suitable for paper, classified according to their properties.

### 1. Colours fast to light.

#### Basic Colours.

Janus Yellow R, G pat.  
 Janus Red B pat.  
 Janus Brown B, R, pat.  
 Janus Blue R, G pat.  
 Janus Green B, G, pat.  
 Janus Grey B, BB pat.  
 Janus Black O, I, II pat.

#### Acid Colours.

Fast Acid Violet R, B, A2R, pat.  
 Acid Violet, all brands.  
 Alkaline Blue, all brands, Methyl Alkaline Blue MLB,  
 Alkaline Violet O, Blue red shade, blueish, TB, 120RMA,  
 Purple Blue O, Cloth Blue O, China Blue R, No. 1,  
 No. 2, Guernsey Blue O, Soluble Blue, all brands, Bleu  
 de Lyon O, R, RR, Opal Blue red shade, blue shade, green  
 shade, Laundry Blue O, Full Blue O, Navy Blue V.  
 Conc. Cotton Blue RR, R, No. 1, No. 2, No. 2 double, Pure  
 Blue O, conc., double conc., double conc. R, Paper Blue  
 8928, 8929, No. 30, Opal Blue sup. sol., Cotton Light Blue  
 O, Cotton Blue extra, OO, Methyl Blue for Cotton MLB,  
 Emperor Blue O.  
 Acid Green, all brands.  
 Patent Blue pat. all brands, Keton Blue 4BN solution, 4BN  
 powder, pat.  
 Patentgreen O, V, VS, pat.  
 Fastblue, all brands, Nigrosine No. 1, 2, 3, 4, A. R.

Fast Pure Yellow CHO, CH extra.  
 Paper Yellow O, MT.  
 Azo Yellow conc., O, R.  
 Orange, all brands, **Brilliant Orange** O, G, R.  
 Scarlet, all brands, **Brilliant Croceine** 8 B.  
 Paper Scarlet, all brands.  
 Clothred O, **Fastred** O, S.  
 Solid Brown O, yellow shade, NT, L.  
 Claret Red, all brands.

### Direct dyeing Colours.

Dianil Yellow 3 G, G, R, 2 R, pat.  
 Oxydianil Yellow O, Paper Yellow O.  
 Dianil Orange G, R, pat.  
 Dianil Red 4 B, Dianil Claret Red G, B, Dianil Scarlet G,  
 2 R, pat.  
 Dianil Blue G, B, R, 2 R, 4 R, BX, pat., Dianil Darkblue R,  
 3 R, pat.  
 Dianil Brown, all brands.  
 Dianil Black, pat., all brands.  
 Dianil New Black LBI pat.  
 Directblack II.

## 2. Colours which are suitable for granite papers (incl. blotting paper).

Dianil Yellow 3 G, G, R, 2 R, pat.  
 Oxydianil Yellow O.  
 Dianil Orange G, R, pat., N.  
 Brilliant Dianil Red R, Delta Purpurine 5 B.  
 Dianil Red R, 4 B, 10 B, Dianil Claret Red G, B.  
 Dianil Scarlet G, 2 R, pat.  
 Dianil Blue G, B, R, 2 R, 4 R, BX, pat., Dianil Darkblue R,  
 3 R, pat.  
 Dianil Brown, all brands.  
 Dianil Green P, G, pat.  
 Dianil Fastbrown B.  
 Dianil Black pat., all brands.  
 Dianil New Black LB I pat.  
 Direct Black II.

## 3. Colours, which are suitable for Ingrain paper.

Amongst the dyestuffs which are especially adapted to dyeing the wool fibres black — (for ingrain papers) — are

**Chrome Black** B pat. and  
**Acid Alizarine Black** R pat.

Our special dyeing instructions for the production of these effects are to be had on application.

## R. COLOURS SUITABLE FOR SOAP DYEING.

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Soap is dyed according to 2 methods:

- a) hot. The Colour solutions are added direct into the refining pan, which contains the liquid melted soap;
- b) cold. The Colour-solutions are added to the thin, dry soap-shavings. This mixture is worked in the mixing machine, until the whole is dyed uniformly.

The colours suitable for method "a" are limited in number, since not all dyestuffs withstand the boiling in the alkaline soap solution equally well. In most cases however the colouring effects which disappear in boiling become again apparent on cooling.

**Vesuvine 4BG** conc.

**Safranine AN** extra, conc. B.

**Ethyl Blue BF** pat.

**Rosazeine O, B, extra, B extra.**

**Fast Acid Violet A 2R** pat.

**Acid Violet 5BF.**

**Patent Blue L, A, V, pat., Keton Blue 4BN** powder, 4BN solution, pat.

**Chinoline Yellow O.**

**Victoria Yellow** conc., double, O, **Azo Yellow** conc., O, R.

**Orange No. 4, No. 2, 2L, No. 64, Brilliant Orange G, O, R.**

**Scarlet, all brands.**

**Brilliant Croceine R, B, 2B, PL, 3B, 5B.**

**Solid Brown L, Fastred O.**

**Soap-Pink O.**

**Soap-Violet B.**

**Soap-Brown I, II, G.**

**Soap-Green B, G.**

**Transparent Green O.**

**Transparent Violet O.**

**Transparent Brown O.**

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## S. COLOURS SUITABLE FOR INK MAKING.

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### a) Aniline inks, multiplex inks.

Magenta, extra yellow small cryst., small cryst. double refined,  
extra yellow.  
New Magenta O pat.  
Methyl Violet, all brands.  
Brilliant Green cryst. extra, Malachite Green cryst. extra.  
Rosazeïne O, B, extra, extra B.  
Coalblack O, I, II.  
Eosine extra.

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### b) Colours for shading Gallnut inks.

Patentblue L, A, V, pat.  
Keton Blue 4BN powder pat.  
Acid Green conc. D, conc. S, conc. M, M.  
Naphthalene Green V pat.  
Nigrosine No. 1, 2, 3, 4.  
Dianil Black R, G, pat.

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## T. COLOURS SUITABLE FOR STRAW AND STRAW FABRICS.

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The straw is boiled for 2 h in water free from lime before dyeing. The straw is then entered into a cold bath, this raised slowly — within  $\frac{3}{4}$  h — to the boil, and the material boiled for 1 h.

### 1. Colours which dye in a neutral bath.

Auramine conc., O, I, II, pat.  
Phosphine extra, O, Yellow for Leather O, G, GG, Red for Leather O, G, R, Brown for Leather O.  
Chrysoïdine A cryst., C cryst., C extra cryst., Vesuvine, all brands.  
Magenta, all brands, Cerise G, R, Grenadine O, R, RR, Maroon O, extra, Cardinal G, R.  
New Magenta O pat.  
Safranine GGS, AN extra, O, conc., conc. B, Methylene Violet 3RA extra, RRN, BN.  
Brilliant Green cryst. extra, Malachite Green cryst. extra.  
Methyl Violet, all brands.  
Methylene Blue, all brands, Methylene Green, all brands.  
New Fast Blue 3R cryst., Fast Blue for Cotton, all brands.  
Coalblack, all brands.

### 2. Colours which dye in a weak Acetic Acid bath.

Auramine conc., O, I, II, pat.  
Chrysoïdine A cryst., C cryst., C extra cryst., Vesuvine, all brands.  
Saffian Red D, Brown A.  
Safranine, all brands.  
Fluorescent Violet B.  
Brilliant Green cryst. extra, Malachite Green cryst. extra.  
Methyl Violet, all brands.

Rosazeïne O, B, O extra, B extra, 4G. 4G extra, pat.  
Methylene Blue, all brands, Methylene Green, all brands.  
New Fast Blue 3R cryst., Fastblue for Cotton, all brands.  
Janus Yellow G, R, pat.  
Janus Red B pat.  
Janus Blue B pat., Janus Green G pat.  
Janus Brown B, R, pat.  
Janus Black I pat.  
Leather Black T, TM, No. 5068.  
Azo Yellow conc., Orange No. 4, G.

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## U. CALICO PRINTING.

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### a) Colours classified according to their mode of fixing.

#### 1. Colours fixed with Tannin.-Basic dyestuffs.

Auramine, all brands, pat.

Phosphine, all brands, Leather Yellow O, G, GG, Leather Red O, Safian Red O, Leather Brown O, Brown A.

Azo Phosphine GO and BRO, pat.

Chrysoidine A cryst., C cryst., C extra cryst., Vesuvine, Cutch Brown, all brands, Dark Brown M, MB.

Magenta, all brands, Acetate of Magenta, Cerise, all brands, Grenadine, all brands, Maroon O, extra, Cardinal R, G.

New Magenta O pat.

Safranine, all brands, Azine Scarlet G conc. pat., Cotton Scarlet O, Methylene Violet, all brands, Methylene Heliotrope O pat.

Methyl Violet, all brands, New Violet, all brands, Fancy Violet O.

Star Violet O, Violet crystals O, Primula R, B.

Victoria Blue B.

Malachite Green, Brilliant Green, all brands.

Rosazeïne 4 G, 4 G extra.

Methylene Blue, all brands, Methylene Indigo O, SS, Thionine Blue GO, Marine Blue, all brands, Methylene Darkblue 3 BN, RBN.

Methylene Green, all brands.

Ethyl Blue BF, BD, RD, pat., New Ethyl Blue B, R, Indamine Blue, all brands, Indophene Blue, all brands, pat.

New Fast Blue 3 R cryst., Fast Blue for Cotton, all brands.

Blue for printing B paste, Induline for printing B powder, R powder, R sol. I, Acetinduline R sol., R sol. new.

Methylene Grey, all brands, New Methylene Grey G, Nigrisine O.

Coal Black, all brands, Leather Black T, TM, No. 5068.

Janus Yellow G, R, pat.

Janus Red B pat.

Janus Brown B, R, pat.

Janus Blue, all brands, pat., Janus Darkblue B, R, pat.

Janus Green G, B, pat.

Janus Black O, I, II, pat., Janus Grey B, BB.

## 2. Colours fixed with Metal salts.

### a. Forming lakes, which are fast to soaping. (Mordant Colours.)

**Alizarine Yellow GG, R, N, Mordant Yellow O**, as a chrome lake.  
**Alizarine Orange**, as an alumina and chrome lake.  
**Alizarine Red**, all brands, as alumina, chrome and iron lakes.  
**Alizarine Brown**, all brands, as alumina and chrome lakes.  
**Alizarine Grenade R**, as alumina and chrome lakes.  
**Alizarine Blue**, all „S“ brands, as chrome and nickel lakes.  
**Alizarine Green S**, as chrome and nickel lakes.  
**Ceruleine**, all brands, as chrome lakes.  
**Solid Green O** paste 50%, as chrome, chrome-copper, and iron lake.

### b. Forming lakes of inferior fastness to washing.

(Used very rarely for prints, and employed only for such articles as have not to undergo any washing process.)

**Eosine, Erythrosine, Rose Bengale, Phloxine**, all brands.  
**Rosazeine, O, B, OG, extra, B extra, G.**  
**Alkaline Blue**, all brands, **Methyl Alkaline Blue MLB, Alkaline Violet O.**  
**Soluble Blue, Opal Blue**, all brands, **Pure Blue O, Full Blue O.**  
**Patent Blue**, all brands, pat., **Cyanine B** pat., **Keton Blue** 4BN sol. pat.  
**Acid Violet N, 5BF.**  
**Fast Acid Violet A 2R, R, B, pat., Fast Acid Eosine G** pat.,  
**Fast Acid Phloxine A** pat., **Fast Acid Magenta G** pat.  
**Brilliant Orange G, Orange G, R.**  
**Victoria Scarlet GG, R, 3R, 5R, 6R.**  
**Scarlet R, 2R, 6R, GRI.**  
**Victoria Rubine O, Solid Brown O.**

## 3. Direct dyeing colours.

(Fixed without any mordants; aftertreated some times with Solidogen A pat.)

**Primuline O.**  
**Oxy Dianil Yellow O, Aurophenine O, Dianil Direct Yellow S.**  
**Cresotine Yellow G.**  
**Dianil Yellow**, all brands, pat.  
**Dianil Orange G** pat., N, **Toluylene Orange R.**  
**Dianil Red R, 4B, 10B, Dianil Claret Red B, G.**  
**Brilliant Dianil Red R, R conc., Delta Purpurine 5B.**



Dianil Scarlet G, 2R, pat., Dianil Blue, all brands, pat.,  
 Dianil Indigo O pat., Dianil Darkblue R, 3R, pat.  
 Dianil Green G pat.  
 Dianil Brown, all brands, Dianil Japonine O, Dianil Copper  
 Brown O, Dianil Fast Brown B.  
 Dianil Black, all brands, pat., Dianil New Black LBI pat.

#### 4. Colours fixed with albumen or caseine.

All colours mentioned under 1, 2 and 3, but rarely used;

All pigment colours such as Chrome Yellow, Chrome Orange, Discharge Red lake, Chrome Green, Ultramarine etc.

#### 5. Vat Colours.

Indigo MLB powder, pat.  
 Indigo MLB extra (99—100%), pat.  
 Indigo MLB/G powder, pat.  
 Indigo MLB paste 20%, pat.  
 Indigo MLB Vat I 20%, pat.  
 Indigo White MLB 40%, pat.

#### 6. Colours produced upon the fibre by a process of oxidation.

Aniline Black (Aniline Oil and Salt).  
 Solidgreen-Brown (Dinitro Resorcine).

#### 7. Colours produced upon the fibre by a process of condensation.

Nitroso Blue (Nitroso dimethyl Aniline, Nitroso diethyl Aniline and Resorcine [Oxyphenol] or Tannoxyphenol R pat., or  $\beta$ -Naphthol or Dioxynaphthalene 2:7 [Oxynaphthol]).

#### 8. Insoluble Azo-Colours produced upon the fibre (Ice-Colours).

Produced with  $\beta$ -Naphthol,  $\alpha$  Naphthol,  $\beta$ -Naphthol R, Naphthol D and the Diazo and Tetrazo-compounds of: Metanitraniline, Paranitraniline, Nitrotoluidine, Nitrophenetidine, Benzidine, Tolidine, Dianisidine, Amidoazobenzol, Amidoazotoluol,  $\alpha$ -Naphthylamine,  $\beta$ -Naphthylamine, Azophor Red PN pat., Azophor Orange MN pat., Azophor Blue D pat., Azophor Black S pat.

## 9. Sulphur Colours.

Melanogen Blue B pat.

Melanogen G, T pat.

Thiogen Brown R pat.

### b) Colours, arranged according to their mode of application.

#### 1. Colours, developed by steaming.

These colours are printed on bleached or on Oil prepared material.

Preparing. 30–50 parts neutral Turkey Red Oil (Sodium or Ammonia Salt) dissolved in 1000 parts.

Steaming. The printed goods are usually steamed for 1–1½ h without pressure either in a closed or open (Continuous) apparatus. Before steaming the goods properly, they are often just passed through the Mather-Platt quick steaming apparatus.

Operations after printing. The colours which are developed by steaming require mostly several other operations in order to be thoroughly fixed:

a) Tartar Emetic bath. This bath is necessary for all basic colours fixed with Tannin. 5–20 parts Tartar Emetic per 1000 parts liquid are required with varying additions of Soda and Chalk to neutralize free acids. A roller cistern is used for this bath, through which the goods pass for about ½ minute at 86–140° F. Instead of Tartar Emetic, other Antimony Salts may be employed.

b) Chalk bath. This answers the purpose of neutralizing free acids. The goods are passed for ½ minute at 86–140° F through this bath, which contains 20 parts of Chalk per 1000 parts of liquid.

c) Chrome bath. This bath is used for the developing of Aniline blacks or of such shades, as contain Cutch. The goods are passed through the cold or lukewarm bath for ½ min.; the bath contains 2–10 parts Bichrome per 1000 parts liquid, likewise mostly some Soda.

d) Malting bath. In order to remove all starchy matter from the goods, they are often malted. This operation is carried out for ¼–½ h at 86–122° F, the goods passing in rope form through the bath containing 20–50 parts of malt per 1000 parts of liq.

e) Soap bath. All steamed goods are soaped after having been treated with Tartar Emetic or Chalk, in rope form or on the continuous broad washing machine. The soap used for this operation must be a good neutral Olive Oil soap. The temperature of the baths is varied according to the colours and requirements of the

trade from lukewarm to boiling. Likewise the amount of soap is varied from 1—5 parts per 1000 parts.

In modern print works which have to cope with very large quantities these different operations are combined and the goods passed in full width through continuous machines.

In order to produce pure whites the goods are finally chlorinated and blued.

The typical recipes for preparing printing pastes (steam-colours) are:

### 1. Basic Dyestuffs.

|       |        |                              |
|-------|--------|------------------------------|
| 20    | parts  | Methylene Blue DBB conc.     |
| 50    | „      | Acetic Acid 12° Tw.          |
| 20    | „      | Acetine                      |
| 178   | „      | Water                        |
| 600   | „      | Thickening St. T. (page 126) |
| 30    | „      | Glycerine                    |
| 2     | „      | Tartaric Acid                |
| 100   | „      | Acetic Acid Tannin sol. 1:1. |
| <hr/> |        |                              |
| 1000  | parts. |                              |

According to this recipe all soluble basic colours may be employed. Of the Methylene Blue and Green brands the so-called D-brands, which are free from Zinc, ought to be used, especially for dark shades. The amount of Tannin is varied according to the strength of the printing colour and quality of the Tannin. For the colour-bases, New Ethyl Blue R and B, 6 parts (instead of 2 parts) of Tartaric Acid are used and the water added after making up the paste.

Instead of Acetine and Tartaric Acid, Ethyl Tartaric Acid can be used (20—30 parts).

For the Induline bases, which do not dissolve easily the following directions are to be observed:

#### Blue for Printing R powder.

|        |        |                                              |
|--------|--------|----------------------------------------------|
| 20     | parts  | Blue for Printing R powder dissolved with    |
| 80     | „      | Ethyltartaric Acid 22° Tw. on the water bath |
| 600    | „      | Acid Starch paste (page 126)                 |
| 100    | „      | Acetic Acid 9° Tw.                           |
| 100    | „      | Water                                        |
| 50—100 | „      | Acetic Acid Tannin sol. 1:1                  |
| <hr/>  |        |                                              |
| 1000   | parts. |                                              |

#### Acetinduline R sol.

|       |        |                              |
|-------|--------|------------------------------|
| 600   | parts  | Acid Starch paste (page 126) |
| 190   | „      | Acetic Acid 6° Tw.           |
| 100   | „      | Acetinduline R sol.          |
| 80    | „      | Acetic Acid Tannin sol. 1:1  |
| 120   | „      | Water                        |
| <hr/> |        |                              |
| 1000  | parts. |                              |

Instead of Ethyltartaric Acid, Acetine may be used for dissolving. In like manner as Blue for Printing, Induline for Printing R and B powder may be used.

The goods printed with basic dyestuffs are steamed without pressure for 1-1½ h, then passed through Tartar Emetic, washed, malted and soaped.

## 2. Dyestuffs fixed with metal salts.

### Alizarine Red.

|       |        |                                         |
|-------|--------|-----------------------------------------|
| 120   | parts  | Alizarine Red paste 20%                 |
| 105   | „      | Water                                   |
| 550   | „      | Thickening for Red (page 127)           |
| 94    | „      | Nitrate Mordant 18° Tw                  |
| 40    | „      | Acetate of Lime 29° Tw                  |
| 28    | „      | Nitro Hydrochlorate of Tin 106° Tw 1:10 |
| 63    | „      | Tartaric Acid 1:10                      |
| <hr/> |        |                                         |
| 1000  | parts. |                                         |

### Alizarine Red on unprepared cloth.

|       |        |                                 |
|-------|--------|---------------------------------|
| 504   | parts  | Thickening for Red (see p. 127) |
| 50    | „      | Para Soap PN                    |
| 120   | „      | Aliz. Red paste 20%             |
| 56    | „      | Acetate of lime 26° Tw          |
| 110   | „      | Sulphocyanide of Alumina 18° Tw |
| 30    | „      | Acetate of Alumina 18° Tw       |
| 100   | „      | Oxalate of Tin 9° Tw            |
| 30    | „      | Tartaric Acid 1:6               |
| <hr/> |        |                                 |
| 1000  | parts. |                                 |

### Alizarine Red with Chrome.

|       |        |                                 |
|-------|--------|---------------------------------|
| 150   | parts  | Aliz. Red paste 20%             |
| 190   | „      | Water                           |
| 500   | „      | Thickening for Red (see p. 127) |
| 100   | „      | Acetate of Chrome 32° Tw        |
| 60    | „      | Acetate of Lime 29° Tw          |
| <hr/> |        |                                 |
| 1000  | parts. |                                 |

### Alizarine Pink.

|       |        |                                                 |
|-------|--------|-------------------------------------------------|
| 20    | parts  | Alizarine Red 20% paste                         |
| 326   | „      | Water                                           |
| 500   | „      | Wheat Starch-Tragacanth Thickening (see p. 126) |
| 40    | „      | Acetic Acid 12° Tw                              |
| 30    | „      | Glycerine                                       |
| 20    | „      | Nitrate Mordant 18° Tw                          |
| 14    | „      | Acetate of Lime 29° Tw                          |
| 50    | „      | Tartaric Acid 1:10                              |
| <hr/> |        |                                                 |
| 1000  | parts. |                                                 |

Alizarine Violet.

|       |        |                                                   |
|-------|--------|---------------------------------------------------|
| 10    | parts  | Aliz. Red No. 1 paste 20%                         |
| 398   | "      | Water                                             |
| 500   | "      | Wheat Starch - Tragacanth Thickening (see p. 126) |
| 50    | "      | Acetic Acid 12° Tw                                |
| 10    | "      | Acetate of Lime                                   |
| 2     | "      | Yellow Prussiate                                  |
| 39    | "      | Water                                             |
| <hr/> |        |                                                   |
| 1000  | parts. |                                                   |

Alizarine Orange with Alumina.

|       |        |                                 |
|-------|--------|---------------------------------|
| 150   | parts  | Alizarine Orange paste 20%      |
| 600   | "      | Thickening for Red (see p. 127) |
| 40    | "      | Acetic Acid 12° Tw              |
| 120   | "      | Nitrate Mordant 18° Tw          |
| 40    | "      | Acetate of Lime 29° Tw          |
| 50    | "      | Tartaric Acid 1:10              |
| <hr/> |        |                                 |
| 1000  | parts. |                                 |

Alizarine Orange with Chrome.

|       |        |                                                 |
|-------|--------|-------------------------------------------------|
| 100   | parts  | Alizarine Orange paste 20%                      |
| 255   | "      | Water                                           |
| 500   | "      | Wheat Starch-Tragacanth Thickening (see p. 126) |
| 30    | "      | Tournant Oil                                    |
| 30    | "      | Glycerine                                       |
| 80    | "      | Acetate of Chrome 32° Tw                        |
| 5     | "      | Tartaric Acid                                   |
| <hr/> |        |                                                 |
| 1000  | parts. |                                                 |

Alizarine Claret with Alumina.

|       |        |                                 |
|-------|--------|---------------------------------|
| 200   | parts  | Alizarine Claret R paste        |
| 40    | "      | Water                           |
| 600   | "      | Thickening for Red (see p. 127) |
| 100   | "      | Nitrate Mordant 18° Tw          |
| 60    | "      | Acetate of Lime 26° Tw          |
| <hr/> |        |                                 |
| 1000  | parts. |                                 |

Alizarine Claret with Chrome.

|       |        |                                                 |
|-------|--------|-------------------------------------------------|
| 200   | parts  | Alizarine Claret R paste                        |
| 150   | "      | Water                                           |
| 500   | "      | Wheat Starch-Tragacanth Thickening (see p. 126) |
| 150   | "      | Acetate of Chrome 32° Tw.                       |
| <hr/> |        |                                                 |
| 1000  | parts. |                                                 |

Alizarine Brown.

|       |        |                                                 |
|-------|--------|-------------------------------------------------|
| 100   | parts  | Alizarine Brown paste                           |
| 260   | "      | Water                                           |
| 500   | "      | Wheat Starch-Tragacanth Thickening (see p. 126) |
| 30    | "      | Tournant Oil                                    |
| 30    | "      | Glycerine                                       |
| 80    | "      | Acetate of Chrome 32° Tw                        |
| 1     | "      | Tartaric Acid                                   |
| <hr/> |        |                                                 |
| 1000  | parts, |                                                 |

## Alizarine Yellow.

|             |                                                                    |
|-------------|--------------------------------------------------------------------|
| 100 parts   | Alizarine Yellow GG paste pat. or R paste, or<br>20 parts N powder |
| 320—400     | „ Water                                                            |
| 500         | „ Wheat Starch-Tragacanth Thickening (see p. 126)                  |
| 80          | „ Acetate of Chrome 32° Tw                                         |
| <u>1000</u> | parts.                                                             |

## Alizarine Blue SB powder.

|             |                                                   |
|-------------|---------------------------------------------------|
| 20—70 parts | Alizarine Blue SB powder                          |
| 460—360     | „ Water                                           |
| 500         | „ Wheat Starch-Tragacanth Thickening (see p. 126) |
| 20—70       | „ Acetate of Chrome 32° Tw                        |
| <u>1000</u> | parts.                                            |

## Alizarine Blue SB paste.

|              |                                                   |
|--------------|---------------------------------------------------|
| 60—210 parts | Alizarine Blue SB paste                           |
| 420—220      | „ Water                                           |
| 500          | „ Wheat Starch-Tragacanth Thickening (see p. 126) |
| 20—70        | „ Acetate of Chrome 32° Tw                        |
| <u>1000</u>  | parts.                                            |

## Alizarine Green S paste.

|             |                                                   |
|-------------|---------------------------------------------------|
| 150 parts   | Alizarine Green S paste                           |
| 280         | „ Water                                           |
| 500         | „ Wheat Starch-Tragacanth Thickening (see p. 126) |
| 60          | „ Bisulphite of Chrome 32° Tw                     |
| 15          | „ Bisulphite of Nickel 32° Tw                     |
| <u>1000</u> | parts.                                            |

## Ceruleine S powder.

|             |                                                   |
|-------------|---------------------------------------------------|
| 40 parts    | Ceruleine S powder pat.                           |
| 360         | „ Water                                           |
| 500         | „ Wheat Starch-Tragacanth Thickening (see p. 126) |
| 100         | „ Acetate of Chrome 32° Tw                        |
| <u>1000</u> | parts.                                            |

## Ceruleine S paste.

|             |                                                   |
|-------------|---------------------------------------------------|
| 200 parts   | Ceruleine S paste pat.                            |
| 200         | „ Water                                           |
| 500         | „ Wheat Starch-Tragacanth Thickening (see p. 126) |
| 100         | „ Acetate of Chrome 32° Tw                        |
| <u>1000</u> | parts.                                            |

## Ceruleine conc.

|             |                                                              |
|-------------|--------------------------------------------------------------|
| 40 parts    | Ceruleine conc.                                              |
| 210         | „ Water                                                      |
| 100         | „ Bisulphite of Soda 66° Tw<br>let stand over for three days |
| 550         | „ Wheat Starch-Tragacanth Thickening (see p. 126)            |
| 100         | „ Acetate of Chrome 32° Tw                                   |
| <u>1000</u> | parts.                                                       |

Steam colours, prepared from Alizarines, are printed mostly on material, which is prepared with Turkey Red Oil (30–50 parts Turkey Red Oil per 1000); they are then steamed for 1–1½ h mostly, without pressure; passed through Chalk, washed and finally soaped.

For Eosines and Acid Colours the following directions are to be observed:

#### Eosine with Chrome.

|             |       |                               |
|-------------|-------|-------------------------------|
| 20–30       | parts | Eosine                        |
| 320–280     | „     | Water                         |
| 600         | „     | Thickening for Red (page 127) |
| 60–90       | „     | Acetate of Chrome 32° Tw.     |
| <u>1000</u> |       | parts.                        |

This recipe answers for all brands of Eosine, Phloxine, Erythrosine, Rose Bengale etc.

#### Scarlet with Alumina.

|             |       |                                               |
|-------------|-------|-----------------------------------------------|
| 30          | parts | Scarlet                                       |
| 370         | „     | Water                                         |
| 500         | „     | Wheat Starch-Tragacanth Thickening (page 126) |
| 100         | „     | Acetate of Alumina 27° Tw                     |
| <u>1000</u> |       | parts.                                        |

Applicable for almost all Azo Colours.

#### Alkaline Blue with Chrome.

|             |       |                                                 |
|-------------|-------|-------------------------------------------------|
| 5–40        | parts | Alkaline Blue                                   |
| 505–350     | „     | Water                                           |
| 450         | „     | Weath Starch-Tragacanth Thickening (see p. 126) |
| 25–100      | „     | Acid Turkey Red Oil                             |
| 15–60       | „     | Bisulphite of Chrome 32° Tw.                    |
| <u>1000</u> |       | parts.                                          |

Applicable for all soluble Rosaniline Blue Sulphonic Acids.

All these colours are printed on bleached material, steamed and scarcely ever washed.

### 3. Direct dyeing Colours.

|             |       |                        |
|-------------|-------|------------------------|
| 40          | parts | Dianil Brown           |
| 440         | „     | Water                  |
| 500         | „     | Gum Tragacanth 60:1000 |
| 20          | „     | Sodium Phosphate       |
| <u>1000</u> |       | parts.                 |

This recipe answers for all Dianil Colours. They are steamed for 1 h and washed.

## 4. Colours fixed with Albumen.

## Eosine.

|             |                        |
|-------------|------------------------|
| 30 parts    | Eosine                 |
| 170 "       | Water                  |
| 500 "       | Gum Tragacanth 60:1000 |
| 300 "       | Albumen sol. 1:1       |
| <hr/>       |                        |
| 1000 parts. |                        |

Applicable for all Phtalic Acid Colours.

## Alizarine Red lake.

|             |                    |
|-------------|--------------------|
| 30—50 parts | Lake               |
| 440—350 "   | Water              |
| 450 "       | Tragacanth 60:1000 |
| 80—120 "    | Albumen sol. 1:1   |
| <hr/>       |                    |
| 1000 parts. |                    |

## Safranine.

|             |                    |
|-------------|--------------------|
| 10—20 parts | Safranine          |
| 380 "       | Water              |
| 450 "       | Tragacanth 60:1000 |
| 150 "       | Albumen 1:1        |
| <hr/>       |                    |
| 1000 parts. |                    |

This recipe is used for the production of light and brilliant shades with Basic Colours.

## Dianil Colours.

|             |                    |                                          |
|-------------|--------------------|------------------------------------------|
| 20—70 parts | Dyestuff           | } boiled, then cooled and<br>mixed with: |
| 730—580 "   | Water              |                                          |
| 200 "       | British Gum powder |                                          |
| 50—150 "    | Albumen 1:1        |                                          |
| <hr/>       |                    |                                          |
| 1000 parts. |                    |                                          |

The so produced prints are steamed for 1 h without pressure and then washed.

## 5. Indigo.

Before printing the material is prepared with a solution of (200—300 parts per 1000) grape sugar, and then dried well (though not rapidly).

|              |                      |
|--------------|----------------------|
| 25—150 parts | Indigo MLB paste 20% |
| 175—0 "      | Water                |
| 800 "        | Alkaline Thickening  |
| 0—15 "       | Soda lye 77° Tw      |
| <hr/>        |                      |
| 1000 parts.  |                      |



**Alkaline Thickening.**

|           |                  |
|-----------|------------------|
| 100 parts | Wheat Starch     |
| 300 „     | British Gum      |
| 1800 „    | Soda lye 77° Tw. |

The printing rollers ought to be engraved deeply and no great pressure (weight) ought to be put on in printing.

After printing the material is carefully dried, then steamed for  $\frac{1}{4}$ — $\frac{1}{2}$  min. in the Mather-Platt at nearly 212° F, without permitting any air to enter the apparatus; then well washed, soured if necessary, and again rinsed in running water.

## 6. Colours produced upon the fibre by a process of oxydation.

**Aniline Black.**

Steam Aniline Black with Prussiate:

|   |           |                      |
|---|-----------|----------------------|
| { | 500 parts | Tragacanth (60:1000) |
|   | 94 „      | Aniline Salt         |
| { | 5 „       | Aniline Oil          |
|   | 25 „      | Chlorate of Soda     |
| { | 150 „     | Water                |
|   | 50 „      | Yellow Prussiate     |
| { | 176 „     | Water                |
|   | 1000      | parts.               |

This Black can be developed by steaming for a short time in a Mather-Platt; but it also withstands a longer steaming process, especially after having been passed through a quick-steaming chamber, and through ammonia. It can therefore be combined with other steam-colours. After printing, the material is passed through a chrome bath (page 116), then washed, and eventually soaped.

Steam Aniline Black with Chromate of Lead.

|   |          |                                                                |
|---|----------|----------------------------------------------------------------|
| { | 60 parts | Wheat-starch                                                   |
|   | 545 „    | Water                                                          |
| { | 120 „    | Chrome Yellow paste 37—58% after mixing well, and boiling      |
|   | 125 „    | Chloride of Ammonia                                            |
| { | 25 „     | Chlorate of Soda are added to the lukewarm mixture; when cold, |
|   | 125 „    | Aniline Salt are added.                                        |

The material is steamed with, or without pressure, washed and soaped.

## 7. Colours produced upon the fibre by a process of condensation.

**Nitroso Colours.**

These colours are printed upon bleached material, carefully dried, (care must be taken, lest the printed pieces touch the hot

drying plates) and steamed in the Mather-Platt with steam of  $210-212^{\circ}\text{F}$  for  $2\frac{1}{2}-5$  min. After steaming, the colour must be properly developed, and the white must be pure and not yellowish. The material is then passed in the usual manner through Tartar emetic, washed and soaped.

#### Nitroso Blue M.D.

|       |        |                               |
|-------|--------|-------------------------------|
| 600   | parts  | Acid Starch (page 126)        |
| 20    | „      | Glycerine                     |
| 24    | „      | Nitroso Base M 50%            |
| 100   | „      | Water                         |
| 8     | „      | Muriatic Acid $36^{\circ}$ Tw |
| 15    | „      | Dioxynaphthalene 2.7          |
| 50    | „      | Acetic Acid $12^{\circ}$ Tw   |
| 27    | „      | Water                         |
| 60    | „      | Oxalic Acid 1:10              |
| 60    | „      | Acetic Acid Tannin sol. 1:1   |
| 36.5  | „      | Sodium Phosphate 1:5          |
| <hr/> |        |                               |
| 1000  | parts. |                               |

#### Nitroso Blue A.D.

|       |        |                                   |
|-------|--------|-----------------------------------|
| 600   | parts  | Acid Starch (see p. 126)          |
| 20    | „      | Glycerine                         |
| 14.4  | „      | Nitroso Base A                    |
| 100   | „      | Water                             |
| 7.1   | „      | Hydrochloric Acid $36^{\circ}$ Tw |
| 15    | „      | Dioxynaphthalene 2.7              |
| 50    | „      | Acetic Acid $12^{\circ}$ Tw       |
| 37    | „      | Water                             |
| 60    | „      | Oxalic Acid 1:10                  |
| 60    | „      | Acetic Acid Tannin solution 1:1   |
| 36.5  | „      | Sodium Phosphate 1:5              |
| <hr/> |        |                                   |
| 1000  | parts. |                                   |

#### Nitroso Blue M.R.

|                                                |        |                                       |
|------------------------------------------------|--------|---------------------------------------|
| 600                                            | parts  | Acid Starch (see p. 126)              |
| 20                                             | „      | Glycerine                             |
| 26                                             | „      | Nitroso Base M 50% paste stirred with |
| 20                                             | „      | Water                                 |
| 8.7                                            | „      | Hydrochloric Acid $36^{\circ}$ Tw     |
| 20                                             | „      | Resorcine dissolved in                |
| 150                                            | „      | Water                                 |
| are added and mixed with the Acid Starch. Then |        |                                       |
| 6                                              | „      | Oxalic Acid dissolved in              |
| 60                                             | „      | Water                                 |
| 60                                             | „      | Acetic Acid Tannin Solution 1:1       |
| are added, and before use add slowly           |        |                                       |
| 40                                             | „      | Sodium Phosphate 1:5                  |
| <hr/>                                          |        |                                       |
| 1000                                           | parts. |                                       |

Nitroso Blue MR shaded.

|                                           |        |                                           |
|-------------------------------------------|--------|-------------------------------------------|
| 600                                       | parts  | Acid Starch (see p. 126)                  |
| 20                                        | "      | Glycerine                                 |
| { 20                                      | "      | Nitroso Base M 50% paste are stirred with |
| { 20                                      | "      | Water and                                 |
| { 6.7                                     | "      | Hydrochloric Acid 36° Tw                  |
| { 15                                      | "      | Resorcine dissolved in                    |
| { 118                                     | "      | Water                                     |
| are added and mixed with the Acid Starch. |        |                                           |
| Then add:                                 |        |                                           |
| { 6                                       | "      | Oxalic Acid dissolved in                  |
| { 60                                      | "      | Water                                     |
| { 2                                       | "      | Violet crystals O                         |
| { 1                                       | "      | Methylene Blue DB                         |
| { 30                                      | "      | Water                                     |
| { 20                                      | "      | Acetic Acid 9° Tw                         |
| 60                                        | "      | Acetic Acid Tannin Solution 1:1.          |
| Before use                                |        |                                           |
| 33                                        | "      | Sodium Phosphate 1:5 are slowly added     |
| 1000                                      | parts. |                                           |

Nitroso Blue TO.

|                               |        |                                   |
|-------------------------------|--------|-----------------------------------|
| I { 600                       | parts  | Acid Starch (see p. 126)          |
| I { 20                        | "      | Glycerine                         |
| I { 24                        | "      | Nitroso Base M 50% paste          |
| I { 8                         | "      | Hydrochloric Acid 36° Tw          |
| II { 152                      | "      | Water                             |
| II { 30                       | "      | Tannoxyphenol R                   |
| II { 60                       | "      | Hot Water                         |
| } dissolved on the water bath |        |                                   |
| 60                            | "      | No. 2 is stirred into No. 1, then |
| 60                            | "      | Oxalic Acid 1:10                  |
| and before use                |        |                                   |
| 36,3                          | "      | Sodium Phosphate 1:5              |
| are added                     |        |                                   |
| 1000                          | parts. |                                   |

Nitroso Blue TO shaded.

|                                             |        |                          |
|---------------------------------------------|--------|--------------------------|
| I { 600                                     | parts  | Acid Starch (see p. 126) |
| I { 20                                      | "      | Glycerine                |
| I { 20                                      | "      | Nitroso Base M 50% paste |
| I { 6,8                                     | "      | Hydrochloric Acid 36° Tw |
| II { 70                                     | "      | Water                    |
| II { 25                                     | "      | Tannoxyphenol R          |
| II { 70                                     | "      | Hot Wasser               |
| } dissolved on the water bath               |        |                          |
| No. 2 is stirred into No. 1, then add:      |        |                          |
| 60                                          | "      | Oxalic Acid 1:10         |
| and after cooling completely                |        |                          |
| { 2                                         | "      | Violet crystals O        |
| { 1                                         | "      | Methylene Blue DBB       |
| { 60                                        | "      | Acetic Acid 12° Tw       |
| 102                                         | "      | Water.                   |
| Before use add slowly whilst stirring well: |        |                          |
| 33                                          | "      | Sodium Phosphate 1:5     |
| 1000                                        | parts. |                          |

## Nitroso Green.

|      |        |                                           |  |
|------|--------|-------------------------------------------|--|
| 600  | parts  | Acid Starch (see below)                   |  |
| 20   | "      | Glycerine                                 |  |
| 13   | "      | Nitroso Base M 50% paste are stirred with |  |
| 47   | "      | Water                                     |  |
| 4,3  | "      | Hydrochloric Acid 36° Tw                  |  |
|      |        | Then add:                                 |  |
| 10   | "      | Resorcine dissolved in                    |  |
| 70   | "      | Water                                     |  |
|      |        | After dissolving add:                     |  |
| 6    | "      | Oxalic Acid dissolved in                  |  |
| 60   | "      | Water                                     |  |
| 5    | "      | Methylene Green O                         |  |
| 13   | "      | Auramine O                                |  |
| 1    | "      | Brilliant Green cryst. extra              |  |
| 38   | "      | Acetic Acid 9° Tw                         |  |
| 40   | "      | Water                                     |  |
| 20   | "      | Acetine                                   |  |
| 80   | "      | Acetic Acid Tannin sol. 1:1.              |  |
|      |        | Before use add slowly                     |  |
| 20   | "      | Sodium Phosphate 1:5                      |  |
| 1000 | parts. |                                           |  |

## Thickenings.

## Acid Starch.

|      |       |                    |                      |
|------|-------|--------------------|----------------------|
| 2400 | parts | Wheat-starch       | } Boiled for 10 min. |
| 6600 | "     | Water              |                      |
| 2000 | "     | Acetic Acid 12° Tw |                      |

Used for dark printing-colours, with basic dye-stuffs.

## Wheat-starch Tragacanth-Thickening.

|      |       |                      |                    |
|------|-------|----------------------|--------------------|
| 225  | parts | Wheat-starch         | } Boiled for 1/2 h |
| 600  | "     | Water                |                    |
| 2100 | "     | Tragacanth (60:1000) |                    |

Used for slightly acid colours, with Mordant dye-stuffs.

## British Gum Thickening.

|     |       |                    |
|-----|-------|--------------------|
| 500 | parts | British Gum powder |
| 500 | "     | Water.             |

## Flour-Tragacanth Thickening.

|      |       |                      |
|------|-------|----------------------|
| 2100 | parts | Wheat Flour          |
| 4500 | "     | Water                |
| 3000 | "     | Tragacanth (60:1000) |
| 450  | "     | Acetic Acid 12° Tw.  |

Boil well.

## Thickening St. T.

|      |       |                      |
|------|-------|----------------------|
| 1200 | parts | Wheat Starch         |
| 6400 | "     | Water                |
| 1800 | "     | Tragacanth (60:1000) |
| 800  | "     | Acetic Acid 12° Tw.  |

Boil for 1/4 h.

Used for light printing colours and for such which do not equalize well.

Thickening for Red.

|       |       |                               |
|-------|-------|-------------------------------|
| 1500  | parts | Wheat Starch                  |
| 300   | "     | Wheat Flour                   |
| 10000 | "     | Water                         |
| 500   | "     | Tragacanth (60:1000)          |
| 700   | "     | Acetic Acid 12° Tw.           |
|       |       | Boil for 10 min. and add cold |
| 1000  | "     | Tournant Oil                  |

Used for Alizarine Red colours.

Thickening TN.

|       |        |                      |
|-------|--------|----------------------|
| 1500  | parts  | Wheat Starch         |
| 3100  | "      | Water                |
| 3100  | "      | Acetic Acid 12° Tw   |
| 1500  | "      | Tragacanth (60:1000) |
| 750   | "      | Tournant Oil         |
| 10000 | parts. |                      |

For 1 h. at 140° F.

## 2. Prints which are not steamed.

### 1. Colours produced upon the fibre by a process of oxydation.

Aniline Oxydation-Black.

|      |        |                         |                           |
|------|--------|-------------------------|---------------------------|
| 100  | parts  | Wheat Starch            | } Boiled, and added hot : |
| 500  | "      | Water                   |                           |
| 75   | "      | Chlorate of Soda.       |                           |
|      |        | When cold, add :        |                           |
| 115  | "      | Aniline Oil             | {                         |
| 100  | "      | Muriatic Acid 36° Tw    |                           |
| 100  | "      | Water.                  |                           |
|      |        | And before use, add :   |                           |
| 12   | "      | of Vanadium Sol. 1:1000 |                           |
| 1000 | parts. |                         |                           |

Vanadium Sol. 1:1000. 10 parts Vanadate of Ammonia are dissolved in 100 parts of Hydrochloric acid 34° Tw and about 400 parts of Water; then 5 parts of Glycerine added, and the Solution heated until it has changed its colour from yellowish green to blue. The whole is made up to 10000 parts. The printing-colour is reduced by 3:1, and printed upon bleached material, hung in the oxydation room for 24 hours, then chromed for 3 minutes at 122° F with bi-chrome solution (5:1000), washed, and soaped.

## 2. Insoluble azo-colours produced on the fibre. (Ice colours).

### a) Printing of thickened Naphthol-solutions and subsequent developing in Diazo-Solutions.

This method of producing insoluble azo-colours, by which very good results are obtained, is still sometimes used for simple styles. The colour described as below is printed and dried well though not quickly, in order to prevent the Naphthol from sublimating.

| Naphthol printing-colour A            |                      |
|---------------------------------------|----------------------|
| (for Paranitraniline and Azophorred). |                      |
| 30 parts                              | $\beta$ -Naphthol    |
| 380                                   | „ Hot Water          |
| 60                                    | „ Soda-lye 36° Tw    |
| 500                                   | „ Tragacanth 60:1000 |
| 30                                    | „ Para-Soap PN       |
| <hr/> 1000 parts.                     |                      |

| Naphthol printing-colour B           |                      |
|--------------------------------------|----------------------|
| (for Alphanaphthylamine Claret-red). |                      |
| 30 parts                             | $\beta$ -Naphthol    |
| 410                                  | „ Hot Water          |
| 60                                   | „ Soda lye 36° Tw    |
| 500                                  | „ Tragacanth 60:1000 |
| <hr/> 1000 parts.                    |                      |

These prints are then developed in Diazo solutions of Paranitraniline,  $\alpha$ -Naphthylamine, etc. (described on pages 145 and 146), washed and soaped.

### b) Printing of thickened Diazo-solutions on Naphthol-prepared material.

The cloth is padded, with grounding liquids described as below, dried in the hot-flue, or over the drying-cylinder, printed with Diazo printing-colours, dried, washed and soaped.

#### Naphthol Grounding.

For Naphthol Grounding, the following ingredients are used:  $\beta$ -Naphthol,  $\beta$ -Naphthol R (for bluish Para-red); Naphthol D (for Dianisidine Blue, fast to perspiration), and  $\alpha$ -Naphthol (occasionally as an addition to  $\beta$ -Naphthol Groundings). Furthermore, Parasoap or Turkey red oil for oil mordants, likewise sometimes Antimony compounds and occasionally Alumina are used.

If the material is dried over the drying cylinder, it is advisable to add Antimony salts to the Naphthol Grounding. According to Dr. Lauber and Dr. Caberti, the addition of Alkaline Antimony-oxide Solution to Naphthol groundings prevents the impregnated material from turning brown, in drying over hot metal, or in lying in the air before dyeing.

The most important Naphthol Groundings are:

Naphthol Grounding for Para-Red and Metanitriline Orange.

|                     | 1.                            | 2.                 |
|---------------------|-------------------------------|--------------------|
| $\beta$ -Naphthol   | 25 parts                      | — parts            |
| $\beta$ -Naphthol R | —                             | 25                 |
| Hot Water           | 200                           | 200                |
| Soda Lye 36° Tw     | 40                            | 50                 |
| Para Soap PN        | 25                            | 25                 |
|                     | <u>make up to 1000 parts.</u> | <u>1000 parts.</u> |

Grounding No. 2 is used for very blue reds.

Naphthol Grounding for  $\alpha$ -Naphthylamine Claret-Red, Benzidine, and Tolidine-Puce.

|                      | 3.       |
|----------------------|----------|
| $\beta$ -Naphthol    | 25 parts |
| Water                | 200      |
| Soda Lye 36° Tw      | 40       |
| Tragacanth (60:1000) | 75       |
| Water                | 500      |

Dilute to 1000 parts.

For dark claret shades with  $\alpha$ -Naphthylamine Claret Red, the following grounding is used:

Naphthol Grounding.

|                      | 4.       |
|----------------------|----------|
| $\beta$ -Naphthol    | 22 parts |
| $\alpha$ -Naphthol   | 3        |
| Soda Lye 36° Tw      | 40       |
| Hot Water            | 200      |
| Tragacanth (60:1000) | 50       |

Dilute to 1000 parts.

The following groundings are especially applicable for cylinder-drying; No. 5 for Paranitriline, No. 6 for  $\alpha$ -Naphthylamine.

|                        | 5.          | 6.       |
|------------------------|-------------|----------|
| $\beta$ -Naphthol      | 25—30 parts | 30 parts |
| Soda Lye 36° Tw        | 40—45       | 45       |
| Hot Water              | 100         | 100      |
| Hydrate of Alumina 50% | 20          | —        |
| Soda Lye 36° Tw        | 15          | —        |
| Neutral Para Soap PN   | 25          | —        |
| Hot Water              | 200         | 200      |
| Tragacanth (60:1000)   | 80          | 80       |
| Tartar Emetic powder   | 3           | 3        |
| Glycerine              | 30          | 30       |
| Hot Water              | 100         | 100      |

Dilute to 1000 parts.

1000 parts.

### Naphthol Grounding for Dianisidine Naphthol Blue and Azophor Blue.

|                       | 7.                    | 8.          |
|-----------------------|-----------------------|-------------|
| $\beta$ -Naphthol     | 25 parts              | — parts     |
| Naphthol D            | — „                   | 25 „        |
| Water                 | 200 „                 | 200 „       |
| Soda Lye 36° Tw       | 50 „                  | 50 „        |
| Para Soap PN          | 50 „                  | 50 „        |
| Sodium Acetate cryst. | 15 „                  | 15 „        |
| Water                 | 500 „                 | 500 „       |
|                       | <hr/>                 | <hr/>       |
|                       | Dilute to 1000 parts. | 1000 parts. |

### Naphthol Grounding for Azophor Black.

|                      | 9.                    |
|----------------------|-----------------------|
| $\beta$ -Naphthol    | 30 parts              |
| Soda Lye 36° Tw      | 75 „                  |
| Tragacanth (60:1000) | 100 „                 |
|                      | <hr/>                 |
|                      | Dilute to 1000 parts. |

### Naphthol Grounding for mixed Diazo compounds.

|                       | 10.                   |
|-----------------------|-----------------------|
| $\beta$ -Naphthol     | 30 parts              |
| Soda Lye 36° Tw       | 60 „                  |
| Para Soap PN          | 25 „                  |
| Tragacanth (60:1000)  | 35 „                  |
| Sodium Acetate cryst. | 30 „                  |
|                       | <hr/>                 |
|                       | Dilute to 1000 parts. |

### Diazo printing-colours.

In order to lessen the tendency of Diazo solutions to decompose in printing, the following precautions are necessary:

1. Diazo printing colours must be prepared in small amounts, and the Acetate of Soda, which is necessary to neutralize the free mineral acid, must be added to the colour immediately before printing.
2. Small copper "furnishing boxes" (chassis) with a false bottom must be used, which allow the Diazo solution to be cooled with cold water, or better still, with ice.
3. For colours, which froth considerably, the chassis may be replaced by a so-called "doctor-box", because thus only a small portion of the colour is exposed, and this, moreover, is constantly replenished.
4. The Naphthol grounding must be made to react very alkaline, or acetate of Soda must be added to it; in the latter case, the addition of sodium acetate to the printing colour, can be dispensed with.
5. In order to prevent the decomposed particles from sticking in the engraving, a revolving brush is advantageously attached to the furnishing box.

The Diazo printing colours are generally prepared by thickening the Diazo solutions with suitable thickening ingredients, and neutralizing the free mineral acids (which hinder the coupling) with Acetate of Soda, or Soda lye.



The best thickening ingredient for Diazo printing colours, as regards shade and stability of the colours is Tragacanth thickening. Flour-Tragacanth, and Wheat-Starch-Tragacanth thickening, which are cheaper, also give good results, whilst Gum, Dextrin, and also British gum, have a decomposing influence upon Diazo-solutions.

**Diazotizing without ice.** This mode of working is to be recommended where it is difficult to obtain ice, or where the latter can only be used sparingly. In this instance, two standard colours are prepared, the one containing the Nitrite solution, and the other, the Diazotizing base, together with the required amount of acid. These two are mixed immediately before printing; the thickening moderates and regulates the reaction, whereby the Diazotizing is less subject to accidents. The standard colours can be kept for any length of time.

Since the introduction of the Azophor Colours (stable Diazo compounds), the printing with Diazo colours has become considerably simplified. These colours can be worked without any particular precaution; no ice is required, and the printing colour, if carefully made, can be printed without any noticeable difference, even in hot rooms.

After printing, the goods are well dried; they must, however, not stand long over the heating-plates of the drying chamber, nor remain long on the drying-cylinders. — The goods are then washed. In order to prevent some loose diazo compounds from tinting the white, it is advisable to have a surplus of Naphthol on the material; or the printing colours must be pretty well diluted (reduced). If the printed pieces are hung overnight in a warm place, or passed quickly through the Mather-Platt (a longer steaming deteriorates the shade), a surplus of diazo-solution is destroyed. The simplest and surest way is, to pass the printed and dried pieces quickly through a hot, slightly acid bath, and then to finish washing in the washing machine. — Instead of the acid bath, boiling soap, or a hot diluted Naphthol solution may also be used. — After washing, the goods are generally soaped, washed again, and dried.

The most important printing colours are made up according to the following directions:

### Paranitraniline Red.

For the preparation of Para-Red printing colour, Paranitraniline extra powder and Azophor-Red PN pat. are used on groundings 1, 2 and 5 (p. 129).

#### Paranitraniline-Red Printing Colour I.

(Diazotizing by means of dissolving in acid.)

|          |        |                                              |
|----------|--------|----------------------------------------------|
| 22       | parts  | Paranitraniline are dissolved in             |
| 120      | „      | Hot Water, and                               |
| 35.2     | „      | Hydrochloric Acid 36° Tw; then cooled, and   |
| 200      | „      | Ice and Water, and at 32° F                  |
| 42       | „      | Nitrite solution (290:1000) added. The whole |
|          |        | is made up to                                |
| 500      | „      | filtered and mixed                           |
| with 500 | „      | Tragacanth (60:1000) and before use          |
| 30—40    | „      | Acetate of Soda crystals are added           |
| 1000     | parts. |                                              |

### Paranitraniline Red Printing Colour II.

(Diazotising from Nitrite paste.)

|       |        |                                                   |
|-------|--------|---------------------------------------------------|
| 22    | parts  | Paranitraniline are made into a paste with        |
| 42    | „      | Nitrite Solution (290:1000) and                   |
| 80    | „      | Cold Water, then stirred slowly into a mixture of |
| 250   | „      | Ice and Water and                                 |
| 35.2  | „      | Hydrochloric Acid 36° Tw. Then left to stand      |
|       |        | for $\frac{1}{4}$ h, filtered, made up to         |
| 500   | „      | and mixed with                                    |
| 500   | „      | Tragacanth (60:1000). Before use                  |
| 30-40 | „      | Sodium Acetate cryst. are added                   |
| 1000  | parts. |                                                   |

### Printing Colour prepared with Azophor Red PN pat.

|      |        |                                                                         |
|------|--------|-------------------------------------------------------------------------|
| 90   | parts  | Azophor Red PN pat. are dissolved in                                    |
| 350  | „      | Water, left to stand for $\frac{1}{2}$ h, filtered and neutralised with |
| 40   | „      | Soda Lye 36° Tw diluted with                                            |
| 100  | „      | Water. This solution is mixed with                                      |
| 500  | „      | Tragacanth (60:1000)                                                    |
| 1000 | parts. |                                                                         |

### Metanitraniline Orange.

For the preparation of this colour m-Nitraniline and Azophor Orange MN pat. are used on groundings 1, 2 and 5 (page 129).

### Printing Colour prepared with m-Nitraniline.

|       |        |                                                                            |
|-------|--------|----------------------------------------------------------------------------|
| 28    | parts  | m-Nitraniline are dissolved in                                             |
| 200   | „      | Hot Water and                                                              |
| 44    | „      | Hydrochloric Acid 36° Tw and cooled whilst stirring well. Then             |
| 100   | „      | Ice are added, and slowly at about 32 to 42° F                             |
| 52    | „      | Nitrite solution (290:1000). After $\frac{1}{4}$ h the whole is made up to |
| 500   | „      | and filtered                                                               |
| 400   | „      | of this Diazo Solution are thickened with                                  |
| 500   | „      | Tragacanth (60:1000) and before printing                                   |
| 30-40 | „      | Sodium Acetate cryst. and                                                  |
| 60    | „      | Water are added                                                            |
| 1000  | parts. |                                                                            |

### Printing Colour prepared with Azophor Orange MN pat.

|      |        |                                                                                                       |
|------|--------|-------------------------------------------------------------------------------------------------------|
| 90   | parts  | Azophor Orange MN pat. are dissolved in                                                               |
| 350  | „      | Water, left to stand for $\frac{1}{2}$ h, filtered and the filtrate gradually neutralised by means of |
| 40   | „      | Soda Lye 36° Tw diluted with                                                                          |
| 100  | „      | Water. This solution is mixed with                                                                    |
| 500  | „      | Tragacanth (60:1000)                                                                                  |
| 1000 | parts. |                                                                                                       |

**$\alpha$ -Naphthylamine Claret.**

For the preparation of  $\alpha$ -Naphthylamine Claret the following products are used:  $\alpha$ -Naphthylamine Base,  $\alpha$ -Naphthylamine Hydrochl. 36% paste, and  $\alpha$ -Naphthylamine Salt S powder; the last named is well adapted for diazotising without ice. Naphthol Groundings 3, 4 and 6 (pages 129).

 **$\alpha$ -Naphthylamine Printing Colour prepared with Base.**

|             |                                                 |
|-------------|-------------------------------------------------|
| 20 parts    | $\alpha$ -Naphthylamine Base are dissolved in   |
| 200 „       | Hot Water and                                   |
| 12.2 „      | Hydrochloric Acid 36° Tw, cooled and then       |
| 150 „       | Ice and                                         |
| 24.5 „      | Hydrochloric Acid 36° Tw are added. At 32° F    |
| 37.4 „      | Nitrite Solution (290:1000) are slowly added    |
|             | whilst stirring. The whole is left to stand for |
|             | 10 min. made up to                              |
| 500 „       | filtered and stirred into                       |
| 500 „       | Tragacanth (60:1000). Before use                |
| 40 „        | Sodium Acetate cryst. are added                 |
| 1000 parts. |                                                 |

 **$\alpha$ -Naphthylamine Printing Colour prepared with  $\alpha$ -Naphthylamine Hydrochl. 36% paste.**

|             |                                                      |
|-------------|------------------------------------------------------|
| 70 parts    | $\alpha$ -Naphthylamine Hydrochl. 36% paste are made |
|             | into a paste with                                    |
| 100 „       | Water                                                |
| 300 „       | Ice and                                              |
| 29 „        | Hydrochloric Acid 36° Tw, at 32° F gradually         |
|             | mixed with                                           |
| 37.5 „      | Nitrite Solution (290:1000) and left to stand for    |
|             | 10 min. The whole is made up to                      |
| 500 „       | filtered and mixed with                              |
| 500 „       | Tragacanth (60:1000). Before use                     |
| 40 „        | Sodium Acetate cryst. are added                      |
| 1000 parts. |                                                      |

 **$\alpha$ -Naphthylamine Printing Colour prepared with  $\alpha$ -Naphthylamine Salt S powder.**

|   |             |                                                     |
|---|-------------|-----------------------------------------------------|
| { | 28 parts    | $\alpha$ -Naphthylamine Salt S powder are made into |
|   |             | a paste with                                        |
|   | 100 „       | Cold Water, then                                    |
| { | 200 „       | Ice and                                             |
|   | 14.4 „      | Sulphuric Acid 168 $\frac{1}{2}$ ° Tw               |
|   | 100 „       | Ice are added. At about 32° F                       |
|   | 37.5 „      | Nitrite Sol. (290:1000) are slowly added, and       |
|   |             | after 10 min. the whole is made up to               |
|   | 500 „       | and mixed with                                      |
|   | 500 „       | Tragacanth (60:1000). Before use                    |
|   | 40 „        | Sodium Acetate cryst. are added                     |
|   | 1000 parts. |                                                     |

*α*-Naphthylamine Printing Colour without Ice.

|                                                               |   |                                 |                                                     |
|---------------------------------------------------------------|---|---------------------------------|-----------------------------------------------------|
| I                                                             | { | 28 parts                        | $\alpha$ -Naphthylamine Salt S powder are made into |
|                                                               |   |                                 | a smooth paste with                                 |
|                                                               |   | 100 „                           | Water and thickened with                            |
|                                                               |   | 250 „                           | Wheat Starch-Tragacanth Thickening (page 126)       |
|                                                               | { | 100 „                           | Water and                                           |
|                                                               |   | 20 „                            | Sulphuric Acid 168 $\frac{1}{2}$ ° Tw are added     |
|                                                               |   | 250 „                           | Wheat Starch-Tragacanth Thickening (page 126)       |
|                                                               |   | 37.4 „                          | Nitrite Sol. (290:1000)                             |
| II                                                            | { | 215 „                           | Water                                               |
| II is slowly added to I, whilst stirring well, and before use |   |                                 |                                                     |
| 40—50                                                         | „ | Sodium Acetate cryst. are added |                                                     |
| <hr/> 1000 parts.                                             |   |                                 |                                                     |

**Dianisidine Naphthol Blue.**

The products used are the following:

Dianisidine Salt dry  
 Dianisidine Salt paste 80 %  
 Dianisidine Sulphate  
 Dianisidine Base  
 Azophor Blue D pat., on  
 Naphthol Groundings 7 and 8 (page 130)

**Dianisidine Salt Printing Colour.**

|            |                                                                |
|------------|----------------------------------------------------------------|
| 16.5 parts | Dianisidine Salt dry are made into a paste with                |
| 10 „       | Hydrochloric Acid 36° Tw and                                   |
| 45 „       | Hot Water and cooled with                                      |
| 300 „      | Ice Water. At 32—42° F                                         |
| 28 „       | Nitrite Solution (290:1000) are added and the whole made up to |
| 500 „      |                                                                |
| 350 „      | of the Diazo Solution thus obtained                            |
| 500 „      | Flour-Tragacanth Thickening (page 126)                         |
| 36 „       | Chloride of Copper 77° Tw and                                  |
| 120 „      | Water are made up to                                           |
| 1000       | parts.                                                         |

The 16.5 parts Dianisidine Salt dry in the above recipe can be replaced by 20.5 parts Dianisidine Salt paste 80 %, or 12.5 parts Dianisidine Base. When working with the Base 15 parts Hydrochloric Acid 36° Tw are used instead of 10 parts.

**Printing Colour prepared with Azophor Blue D pat.**

|       |                                        |
|-------|----------------------------------------|
| 36 „  | Azophor Blue D pat. dissolved in       |
| 300 „ | Water, filtered and made up to         |
| 350 „ | which are stirred into                 |
| 600 „ | Flour-Tragacanth Thickening (page 126) |
| 50 „  | Chloride of Copper 77° Tw and          |
| 4 „   | Chromic Acid cryst. are added          |
| 1000  | parts.                                 |

**Benzidine Brown.**

Benzidine Base and Sulphate are used on Naphthol Grounding 3 (page 129).

**Benzidine Base Printing Colour.**

|            |                                                   |
|------------|---------------------------------------------------|
| 14.4 parts | Benzidine Base are dissolved at the boil in       |
| 150        | „ Water and                                       |
| 16         | „ Hydrochloric Acid 36° Tw. After cooling         |
| 200        | „ Ice and                                         |
| 27.2       | „ Hydrochloric Acid 36° Tw are added and at       |
|            | 32° F gradually                                   |
| 41.6       | „ Nitrite Solution (290:1000). After 5 to 10 min. |
|            | the whole is made up to                           |
| 500        | „ and mixed with                                  |
| 500        | „ Tragacanth (60:1000). Before use                |
| 42         | „ Sodium Acetate cryst. are added                 |
| 1000       | parts.                                            |

**Tolidine Brown.**

Tolidine Brown is a little faster to light than Benzidine Brown and is produced with Tolidine Base. Naphthol Grounding 3 (page 129).

The printing colour is prepared in the same way as stated under Benzidine Brown, only the 14.4 parts Benzidine Base are replaced by 17 parts Tolidine Base.

**Blue Red O.**

Blue Red O (Nitrophenetidine 25%) is used for producing Pink printing colours upon Naphthol grounding. Naphthol groundings No. 1 and 2 are suitable for this purpose (page 129). The base is diazotized without ice at a temperature of 68–77° F.

If light shades are printed on material, which has been grounded with concentrated Naphthol solutions it is necessary to make the printing colours sufficiently acid, to counteract the superfluous alkali contained in the grounding, which might give rise to unevenness of the prints.

**Diazo solution:**

|           |                                                            |
|-----------|------------------------------------------------------------|
| 146 parts | Blue Red O (Nitrophenetidine 25%) are carefully mixed with |
| 66        | „ Nitrite solution (290:1000) and                          |
| 40        | „ Water and then slowly added at 77° F to a mixture of     |
| 80        | „ Muriatic Acid 36° Tw and                                 |
| 250       | „ Water. The whole, when dissolved, is made up to          |
| 1000      | parts and filtered.                                        |

This Diazo solution is distinguished for its stability.

|                        | Light pink.      | Dark pink.       |
|------------------------|------------------|------------------|
| Diazosolution          | 150 parts        | 500 parts        |
| Tragacanth 60:1000     | 600 „            | 500 „            |
| Water                  | 150 „            | — „              |
| Acetic Acid 12° Tw     | 100 „            | — „              |
| Acetate of Soda cryst. | 20 „             | 50 „             |
|                        | <hr/> 1000 parts | <hr/> 1000 parts |

### Azophor Black.

A printing colour containing Azophor Black S pat. is mostly used for 2 or multicoloured styles. If it is printed together with a white Resist, the latter must be applied after the Black, so as not to impair it.

In preparing the printing colour Acetic Acid is used for dissolving the Azophor Black, and, instead of Acetate of Soda, caustic Soda is used for neutralizing the mineral acid. Azophor Black S printed upon a grounding containing Tragacanth (page 129) produces fuller blacks than is possible to obtain on a grounding prepared with Para Soap. If the engraving of the printing rollers is very deep, the colour must be reduced, as brownish blacks are obtained, if this precaution is not taken. It is also advisable to thicken the printing colour considerably.

### Azophor Black printing colour.

|                                                          |
|----------------------------------------------------------|
| 80 parts Azophor Black S pat. are dissolved in           |
| 65 „ Acetic Acid 12° Tw and                              |
| 195 „ Water; then                                        |
| { 80 „ Soda lye 36° Tw and                               |
| { 80 „ cold Water are added and the whole thickened with |
| 500 „ Flour Tragacanth Thickening (page 126)             |
| <hr/> 1000 parts.                                        |

Before printing the colour is filtered.

## 3. Dyed effects, dyed print effects, and padded effects.

### 1. Basic Colours.

Dyed effects page 31.

### 2. Mordant Colours.

The mordants of Alumina, Iron and Chrome (both as separate mordants or mixtures) are printed or padded mostly together with Oxydation Aniline Black and then the fixed mordants are dyed.

**a) Alumina Mordant.****Printing Colour.**

|             |                                                        |
|-------------|--------------------------------------------------------|
| 80 parts    | Wheat Starch                                           |
| 38 "        | Water                                                  |
| 50 "        | burnt Starch                                           |
| 800 "       | Acetate of Alumina 10 <sup>1</sup> / <sub>2</sub> ° Tw |
| 16 "        | Olive Oil                                              |
| 16 "        | Turpentine                                             |
| 1000 parts. | Boiled, cooled and filtered.                           |

**Alumina Mordant (padding liquid).**

A solution of Acetate, Sulphate or basic Sulphate of Alumina of 9—12° Tw is used for padding.

The addition of small amounts of Tin compounds to the printing paste or padding liquid makes the shade yellower and the red appears more brilliant. After printing or padding the mordant is fixed by hanging the pieces in the Oxydation-chamber (97° F heat and 90° F humidity). This will at the same time develop any Oxydation Aniline Black, which might have been printed along with the mordant colour.

The latter can also be fixed by passing the pieces through the Mather-Platt quick steaming apparatus and then through an Ammonia chamber. Then the material is "boiled off" (degummed).

For this purpose Chalk, Silicate of Soda, Phosphate of Soda or sometimes cow-dung are used in varying proportions.

Likewise Malt, especially for the second boiling-off bath, offers advantages.

**Degumming bath No. 1 (Boiling-off bath).**

|          |                          |                          |
|----------|--------------------------|--------------------------|
| 20 parts | Silicate of Soda 32° Tw  | } per 1000 parts liquid. |
| 2 "      | Phosphate of Soda Cryst. |                          |
| 10 "     | Malt                     |                          |

The pieces are passed through this bath at 140° F for 2 min. and are then washed. Then follows

**Degumming bath No. 2 (Boiling-off bath)**

in which the goods are malted for 10 min. and then well washed.

In order to obtain a brilliant red together with a pure white several precautions must be observed: The material must be well bleached. (To prove this the unprinted parts of the pieces are dyed with some Alizarine: no marks or cloudy places must become apparent). The mordant must be properly fixed by the hanging and degumming process; and the white must be well cleansed through washing in clean water.

The goods are then dyed with Alizarine Red, with certain additions to the dye bath, such as Tannin, Glue, Sumach, Blood, Albumen, Turkey Red Oil etc., which partly increase the beauty and depth of the Red, partly favourably influence the purity of the white.

Dye bath (for 100 lbs of material).

7½ lbs Alizarine Red paste 20%  
 ¾ „ Tannin  
 ¾ „ Glue  
 2½ „ Turkey Red Oil  
 1 „ Chalk  
 250 Gall Water.

The pieces are treated cold for 10 min. then the temperature raised in 10 min. to 104° F; in further 10 min. to 140° F and the goods worked at 140° F for 50 min. Then they are washed, treated for 10 min. at 140° F in a bath containing 20 parts bran per 1000 parts liquid, washed again and dried.

In order to convert the brownish Alizarine Lake into the brilliant Turkey Red shade, the pieces are oiled with Turkey Red Oil, dried, steamed and finally soaped.

Oiling. 50 parts of Turkey Red Oil per 1000 parts of liquid. To this bath are added sometimes certain amounts of Oxalate of Ammonia or Arsenate of Soda, in order to produce a purer white.

{ 40 Gall Water  
 { 4 lbs Ammonia Turkey Red Oil 60%  
 { 6 oz Oxalic Acid  
 { 6 Gall Water neutralized with Ammonia and made up to  
 50 Gall.

Steaming: 1 h under pressure of 1½ atm.

Soaping: 10 min. at 140° F with 2 parts of soap per 1000 of liquid. After soaping the goods are sometimes passed through chlorine gas in order to purify the white.

Suitable for Alumina printing and dyeing styles are: **Alizarine Orange, Alizarine Red, Alizarine Brown, Alizarine Claret.**

### b) Chrome Mordant.

The white, bleached material is passed twice through the light-Chrome Mordant on the 2 roller padding machine and then, without drying, passed through a 3% solution of Soda at 140–176° F. After this it is washed and dried.

Upon this slightly chrome-mordanted material Discharge White (page 155) and Dark Chrome Colour are printed; then the pieces are steamed for an hour under slight pressure and finally well washed.

#### Light-Chrome Mordant.

80 parts Chrome Mordant GAI 64° Tw  
 920 „ Water  
 1000 parts.

#### Dark Chrome printing Colour.

750 parts Thickening TN (page 127)  
 250 „ Acetate of Chrome 32° Tw  
 1000 parts.



### Dye bath.

The dyebath is prepared for 100 lbs of material with 3 lbs Alizarine Orange paste and the 50 fold amount of water. The pieces are dyed with a little Acetic Acid cold for  $\frac{1}{4}$  h, the temperature is then raised within  $\frac{3}{4}$  h to the boil and the goods boiled until the colour is properly developed. Then they are washed, and soaped in the usual manner.

For dark blotches the Mordant is made stronger according to requirements.

### Chrome Mordant GAII for dark effects.

|       |        |                            |
|-------|--------|----------------------------|
| 200   | parts  | Chrome Mordant GAII 64° Tw |
| 30    | „      | Glycerine                  |
| 770   | „      | Water                      |
| <hr/> |        |                            |
| 1000  | parts. |                            |

Another Chrome Mordant, which is easily fixed is Horace Koechlin's so-called Alkaline Chrome Mordant.

|       |        |                                         |
|-------|--------|-----------------------------------------|
| 250   | parts  | Acetate of Chrome 32 $\frac{1}{2}$ ° Tw |
| 320   | „      | Caustic Soda 71 $\frac{1}{2}$ ° Tw      |
| 10    | „      | Glycerine 52 $\frac{1}{2}$ ° Tw         |
| 420   | „      | Water                                   |
| <hr/> |        |                                         |
| 1000  | parts. |                                         |

The pieces are padded with this mordant, rolled up, left to lie for several hours and then well washed.

Besides the above mordants, Chrome Bisulphite is sometimes used.

The firm of Rolffs & Co. hold a patent for producing fast dark blue effects upon mixed Chrome-Iron mordants (D.R.P. 97686): The pieces are mordanted in the usual manner with alkaline Chrome-mordant, then passed through Ferrous or Ferric oxide-mordant, dried and oxidised (by hanging); the Iron mordant fixed with Chalk or Silicate of Soda and finally the pieces dyed with blue Mordant-Colours. The usual discharge colours (page 155) produce coloured effects upon these blues. Since the Iron-mordant has a tendency to darken the colours, very cheap and fast effects are produced by this method. If Alizarine Brown is used for dyeing, very dark, full and at the same time cheap browns are obtained which are distinguished for their fastness to light and washing.

The following colours are suitable for Chrome printing and dyeing styles:

Alizarine Orange, all brands  
 Alizarine Red, all brands, excepting the "S" brands.  
 Alizarine Claret R.  
 Alizarine Brown, all brands.  
 Alizarine Blue, all the S (Bisulphite) brands.  
 Alizarine Green S, powder and paste.  
 Alizarine Yellow GG, R, N.  
 Mordant Yellow O.  
 Ceruleine, all the S (Bisulphite) brands.  
 Galleine, all brands.

## c) Iron Mordant.

The most used Iron mordant, which is applied either by itself or in conjunction with Alumina and Chrome Mordants, is Pyrolignite of Iron, to which are sometimes added small amounts of Arsenic Compounds (Arsenic Glycerine) or of Chloride of Ammonia.

The following colours are suitable for dyeing upon Iron Mordants:

**Alizarine Red**, all brands, with exception of the "S" brands,  
**Solid Green O** paste 50%.

Iron Mordant dyed with Solid Green O.

Iron Mordant.

|             |                             |
|-------------|-----------------------------|
| 300 parts   | Pyrolignite of Iron 21½° Tw |
| 500 „       | Water                       |
| 80 „        | Acetic Acid 12° Tw          |
| 100 „       | Acid Starch (page 126)      |
| 20 „        | Chloride of Ammonia         |
| <hr/>       |                             |
| 1000 parts. |                             |

The well bleached material is padded with the Iron mordant, dried in the hotflue, and printed with Discharge White (page 157). After hanging the pieces for 24 h at 89° F (28° humidity) in the Oxidation Chamber (or passing them through the Mather-Platt quick steaming apparatus) they are treated for 3 min. at 140° F in a bath containing 20 parts Phosphate of Soda and 30 parts of Chalk per 1000 parts, then well washed and finally dyed with 6–10% Solid Green O paste 50%. It is best to use water free from lime for dyeing and to heat the bath (without the addition of Acid) within 1 h to the boil and to boil for ½ h. In order to obtain a pure white the pieces are washed after dyeing in the usual manner, treated with bran, soaped and chlorinated.

Alumina-Iron Mordant.

|             |                            |
|-------------|----------------------------|
| 870 parts   | Acetate of Alumina 9.8° Tw |
| 100 „       | Pyrolignite of Iron 15° Tw |
| 30 „        | Glycerine                  |
| <hr/>       |                            |
| 1000 parts. |                            |

Chrome-Iron Mordant.

|             |                            |
|-------------|----------------------------|
| 80 parts    | Chrome Mordant GALL 64° Tw |
| 120 „       | Pyrolignite of Iron 15° Tw |
| 30 „        | Glycerine                  |
| <hr/>       |                            |
| 1000 parts. |                            |

The padded pieces are treated exactly as described for Alumina and Chrome Mordants (pages 137–139).

## d) Steam padding colours, prepared with Mordant Dyestuffs.

1. Colours which are fixed in a second bath with the mordant.

(Erban-Spechts Method page 47.)

2. Colours which are fixed in the same bath with the mordant.

The padding liquid contains besides the mordant colours the necessary mordants. In order to obtain level shades it is advisable to add to the padding liquid certain dissolving ingredients such as Alkalies, Borax, Glycerine, Turkey Red Oil etc.

The material is padded, dried in the hotflue, printed with Resist Colours (page 156 157), dried again, steamed for 1 h without pressure, washed and soaped. If Steam Aniline Black is printed along with the other Colours, it is to be made rather more acid (Tartaric Acid is generally used for this purpose) on account of the Alkali contained in the padding liquid. Before steaming for 1 h these pieces are passed through the Mather-Platt.

Mode-colour.

|             |                           |
|-------------|---------------------------|
| 30 parts    | Alizarine Yellow N powder |
| 21 „        | Alizarine Red No. 1 paste |
| 3.5 „       | Alizarine Green S paste   |
| 850 „       | Water                     |
| 22 „        | Borax                     |
| 100 „       | Acetate of Chrome 32° Tw  |
| <u>1000</u> | parts.                    |

Fraise-Colour.

|             |                          |
|-------------|--------------------------|
| 60 parts    | Alizarine No. 1          |
| 20 „        | Ammonia                  |
| 25 „        | Glycerine                |
| 50 „        | Tragacanth (60:1000)     |
| 815 „       | Water                    |
| 30 „        | Acetate of Chrome 32° Tw |
| <u>1000</u> | parts.                   |

Solid Green-Bistre.

Alkaline Solid Green solutions, padded on cotton material and steamed, produce brown shades, which can be shaded off with Alizarine Colours (together with Acetate of Chrome) and are discharged by means of the Sulphite Resist Colours (page 157).

Solid Green solutions are prepared with Borax, Ammonia, and Caustic Soda. For light and medium shades Borax acts as a sufficiently strong dissolving agent. Dark shades require the presence of Ammonia or Caustic Soda. To these solutions can be added Alizarine Colours and Acetate of Chrome, for fixing. The addition of an alkaline Copper solution increases the fastness to light considerably.

Padding liquids.

I.

|              |                                       |
|--------------|---------------------------------------|
| { 120 parts  | Solid Green O paste are stirred into  |
| { 2000 „     | Water and then added to a solution of |
| { 150 „      | Borax and                             |
| { 2000 „     | Water. To this are added              |
| { 50 „       | Turkey Red Oil                        |
| { 2000 „     | Water and                             |
| { 150 „      | Acetate of Chrome 32° Tw              |
| { 2000 „     | Water                                 |
| <u>10000</u> | parts.                                |

## II.

|              |      |       |                          |
|--------------|------|-------|--------------------------|
| {            | 120  | parts | Solid Green O paste      |
| {            | 2000 | "     | Water                    |
| {            | 150  | "     | Borax                    |
| {            | 2000 | "     | Water                    |
| {            | 50   | "     | Turkey Red Oil           |
| {            | 1000 | "     | Water                    |
| {            | 150  | "     | Acetate of Chrome 32° Tw |
| {            | 2000 | "     | Water                    |
| {            | 150  | "     | Alkaline Copper Solution |
| {            | 2000 | "     | Water                    |
| <hr/>        |      |       |                          |
| 10000 parts. |      |       |                          |

## III. (shaded).

|              |      |       |                          |
|--------------|------|-------|--------------------------|
| {            | 80   | parts | Solid Green O paste      |
| {            | 66   | "     | Soda Lye 36° Tw          |
| {            | 2000 | "     | Water                    |
| {            | 40   | "     | Ceruleine conc.          |
| {            | 132  | "     | Soda Lye 36° Tw          |
| {            | 2000 | "     | Hot Water                |
| {            | 35   | "     | Turkey Red Oil           |
| {            | 1000 | "     | Water                    |
| {            | 170  | "     | Acetate of Chrome 32° Tw |
| {            | 1000 | "     | Water                    |
| {            | 150  | "     | Alkaline Copper Solution |
| {            | 1000 | "     | Water                    |
| <hr/>        |      |       |                          |
| 10000 parts. |      |       |                          |

## IV.

|              |      |       |                          |
|--------------|------|-------|--------------------------|
| {            | 800  | parts | Solid Green O paste      |
| {            | 2000 | "     | Water                    |
| {            | 450  | "     | Borax                    |
| {            | 2000 | "     | Water                    |
| {            | 500  | "     | Ammonia                  |
| {            | 50   | "     | Turkey Red Oil           |
| {            | 2000 | "     | Water                    |
| {            | 150  | "     | Alkaline Copper Solution |
| {            | 2000 | "     | Water                    |
| <hr/>        |      |       |                          |
| 10000 parts. |      |       |                          |

## Alkaline Copper Solution.

|      |       |                        |
|------|-------|------------------------|
| 1000 | parts | Copper Chloride 77° Tw |
| 500  | "     | Tartaric Acid          |
| 1200 | "     | Soda Lye 77° Tw        |
| 400  | "     | Glycerine.             |

Eosines, padded with Chrome-mordants.

The bleached material is padded with the padding liquids; dried; if required printed with Steam-aniline black by itself or together with White discharges containing Tartaric Acid; steamed for 1 h without pressure; washed and slightly soaped.

Padding Liquid.

|   |             |       |                       |
|---|-------------|-------|-----------------------|
| { | 3           | parts | Eosine                |
| { | 100         | „     | Water                 |
| { | 100         | „     | Gum Solution (1:1)    |
| { | 750         | „     | Water                 |
|   | 30          | „     | Chrome Acetate 32° Tw |
|   | <hr/>       |       |                       |
|   | 1000 parts. |       |                       |

In this manner all Eosines, Phloxines, Rose Bengales etc. can be used.

### 3. Direct dyeing Colours.

Dyed effects page 25.

Padding liquids. In order to fix padding liquids prepared of Direct dyeing colours, Phosphate of Soda is used. After padding, the pieces are either dried over cylinders only or sometimes slightly steamed.

Padding Liquid.

|            |            |                      |
|------------|------------|----------------------|
|            | 2 parts    | Colouring matter     |
| 50—100     | „          | Tragacanth (60:1000) |
| 7—10       | „          | Phosphate of Soda    |
| <hr/>      |            |                      |
| make up to | 1000 parts |                      |

### 4. Indigo.

Dyed effects page 52.

### 5. Colours produced upon the fibre by a process of oxidation.

Aniline Black padding liquid.

The bleached or boiled material is padded on the padding machine; dried in the hotflue; printed if required with Resists, (Prud'hommes Black styles, page 168 & 169), steamed for 2 min. in the Mather-Platt; passed through a Chrome bath (5 Bichrome per 1000) at 122° F for 1—1½ min.; washed and dried. Instead of the Chrome bath, to which some Soda is mostly added, also a Silicate of Soda-bath may be used.

|   |             |       |                      |
|---|-------------|-------|----------------------|
| { | 84          | parts | Aniline Salt         |
| { | 40          | „     | Tragacanth (60:1000) |
| { | 5           | „     | Aniline Oil          |
| { | 220         | „     | Water                |
| { | 54          | „     | Yellow Prussiate     |
| { | 280         | „     | Water                |
| { | 30          | „     | Chlorate of Soda     |
| { | 320         | „     | Water                |
|   | <hr/>       |       |                      |
|   | 1000 parts. |       |                      |

## 6. Colours produced upon the fibre by a process of condensation.

### Resorcine Blue MR.

For Resorcine Blue padding styles the goods are padded; then dried in the hotflue; printed if required with Resist Colours (page 169); steamed for 2-3 min. in the Mather-Platt powerful steam (210-212° F); passed through Tartar Emetic; washed and slightly soaped. The steamed pieces are finished off by passing at full width through the fixing and washing bath and over the drying machine. If there is no hotflue at hand, the pieces after having been padded with the Nitroso liquid, may also be dried carefully and not too quickly over the drying cylinder. In this case a suitable White Resist may be printed upon the unpadded material.

The following materials are used for producing Resorcine-Blues: Nitroso Base M paste and Resorcine or Tannoxyphenol R pat.

### Padding liquids.

#### a) Resorcine.

##### Unshaded:

|   |              |                                                  |
|---|--------------|--------------------------------------------------|
| { | 240 parts    | Nitroso Base M 50% paste                         |
|   | 500 „        | lukewarm Water                                   |
|   | 80 „         | Hydrochloric Acid 36° Tw                         |
|   |              | stir well and add the cold solution of:          |
| { | 160 „        | Resorcine                                        |
|   | 160 „        | Water                                            |
|   |              | then:                                            |
|   | 600 „        | Tannin dissolved in Water 1:1                    |
|   | 600 „        | Oxalic Acid sol. 1:10                            |
|   |              | stir the obtained solution into:                 |
|   | 1000 „       | Gum Tragacanth (60:1000)                         |
|   |              | make up to 8000 parts and add before use slowly: |
| { | 80 „         | Sodium Phosphate cr.                             |
|   |              | dissolved in                                     |
|   | 2000 „       | Water                                            |
|   | 10000 parts. |                                                  |

##### Shaded:

|    |   |                |                                         |  |
|----|---|----------------|-----------------------------------------|--|
| I  | { | 200 parts      | Nitroso Base M 50% paste                |  |
|    |   | 500 „          | lukewarm Water                          |  |
|    |   | 70 „           | Hydrochloric Acid 36° Tw                |  |
|    |   |                | stir well and add the cold solution of: |  |
|    | { | 100 „          | Resorcine                               |  |
|    |   | 100 „          | Water                                   |  |
|    |   |                | then:                                   |  |
|    |   | 600 „          | Acetic Acid Tannin sol. 1:1             |  |
|    |   | 600 „          | Oxalic Acid sol. 1:10                   |  |
|    | { | 600-1000 parts | Gum Tragacanth 60:1000                  |  |
| II |   | 200 parts      | Glycerine                               |  |
|    |   | 100 „          | Shading Blue B                          |  |
|    |   | 2000 „         | hot Water                               |  |

pour solution I into the cold solution II.  
make up to

|                     |                            |
|---------------------|----------------------------|
| 8000 parts          | and before use add slowly: |
| { 60 „              | Phosphate of Soda cr.      |
| { 2000 „            | Water                      |
| <u>10000</u> parts. |                            |

### b) Tannoxyphenol.

|                     |                                 |
|---------------------|---------------------------------|
| { 240 parts         | Nitroso Base M 50% paste        |
| { 5000 „            | Water                           |
| { 80 „              | Muriatic Acid 36° Tw            |
| 300 „               | Tannoxyphenol R                 |
| 1000 „              | boiling Water                   |
| 600 „               | Oxalic Acid sol. 1:10           |
| 9000 „              | make up with cold water to:     |
|                     | and before use add slowly       |
|                     | and whilst stirring constantly: |
| { 80 „              | Phosphate of Soda, dissolved in |
| { 1000 „            | cold water                      |
| <u>10000</u> parts. |                                 |

## 7. Insoluble Azo Colours produced upon the fibre (Ice-Colours).

The material is padded with Naphthol Groundings as described on page 129 and 130 then dried in the hotflue or over drying cylinders and finally dyed in the developing baths.

### Paranitraniline Red.

Naphthol Grounding 1, 2, 5 (see page 129):

#### a) By dissolving in acid.

|                    |                                               |
|--------------------|-----------------------------------------------|
| 14 parts           | Paranitraniline powder extra, dissolve in     |
| 60 „               | Boiling Water and                             |
| 22 „               | Hydrochloric Acid 36° Tw; whilst cooling      |
|                    | stir well, in order to precipitate the para-  |
|                    | nitraniline in very fine particles, then add  |
| 100 „              | Ice, and at 32–36° F add                      |
| 26 „               | Sodium Nitrite solution (290 parts per        |
|                    | 1000 parts water). — After frequent stirring, |
|                    | filter and before use add                     |
| 30 „               | Sodium Acetate, and dilute with water to      |
| <u>1000</u> parts. |                                               |

## b) As Nitrite paste.

|             |       |                                                                                                                                     |
|-------------|-------|-------------------------------------------------------------------------------------------------------------------------------------|
| 14          | parts | Paranitraniline extra, make into a paste with                                                                                       |
| 10          | „     | Warm Water, then cool and add                                                                                                       |
| 26          | „     | Sodium Nitrite solution (290 parts per 1000 parts water). Whilst stirring continuously the whole is gradually added to a mixture of |
| 22          | „     | Hydrochloric Acid 36° Tw and                                                                                                        |
| 200         | „     | Ice-water and Ice. — After frequent stirring, filter, and before use add                                                            |
| 30          | „     | Sodium Acetate, and dilute with water to                                                                                            |
| <u>1000</u> |       | parts.                                                                                                                              |

## Azophor Red PN pat.

Naphthol Grounding 1, 2 and 5 (see page 129)

|             |       |                                                                                        |
|-------------|-------|----------------------------------------------------------------------------------------|
| 56          | parts | Azophor Red PN, make into a smooth paste with                                          |
| 400         | „     | water; let stand for $\frac{1}{2}$ hour, and when dissolved filter and neutralize with |
| 25          | „     | Caustic Soda 36° Tw diluted with                                                       |
| 100         | „     | Water; then add                                                                        |
| 500         | „     | Water                                                                                  |
| <u>1000</u> |       | parts.                                                                                 |

 $\alpha$ -Naphthylamine Claret.

Naphthol Grounding 3, 4 and 6 (see page 129).

From  $\alpha$ -Naphthylamine Base

|             |   |                                                                                          |
|-------------|---|------------------------------------------------------------------------------------------|
| {           |   | 14,3parts $\alpha$ -Naphthylamine Base are dissolved in                                  |
| 300         | „ | Hot Water and                                                                            |
| 10          | „ | Hydrochloric Acid 36° Tw. Cool and add                                                   |
| 20          | „ | Hydrochloric Acid 36° Tw and                                                             |
| 200         | „ | Ice. Cool to about 32° F and add gradually whilst stirring well                          |
| 26          | „ | Sodium Nitrite solution (290 parts per 1000 parts Water). Then filter and before use add |
| 30          | „ | Sodium Acetate cryst. and dilute with cold water to                                      |
| <u>1000</u> |   | parts.                                                                                   |

From  $\alpha$ -Naphthylamine Hydrochloride paste 36%.

|             |   |                                                                                                        |
|-------------|---|--------------------------------------------------------------------------------------------------------|
| {           |   | 50 parts $\alpha$ -Naphthylamine Hydrochloride paste 36%, make into a paste with                       |
| 50          | „ | cold Water, add                                                                                        |
| 200         | „ | Ice. Then add slowly at 32° F                                                                          |
| 20          | „ | Hydrochloric Acid 36° Tw                                                                               |
| 26          | „ | Sodium Nitrite sol. (290 parts per 1000 parts Water) and filter after 10 to 15 minutes. Before use add |
| 30          | „ | Sodium Acetate cryst. and dilute to                                                                    |
| <u>1000</u> |   | parts.                                                                                                 |



From  $\alpha$ -Naphthylamine Salt S powder.

|      |                                                                                      |
|------|--------------------------------------------------------------------------------------|
| 19,2 | parts $\alpha$ -Naphthylamine Salt S powder, make carefully into a paste with        |
| 200  | „ cold Water, and add                                                                |
| 10   | „ Sulphuric Acid 168° Tw                                                             |
| 200  | „ Ice. Then add slowly whilst stirring well at about 32° F                           |
| 26   | „ Sodium Nitrite sol. (290:1000). Let stand $\frac{1}{4}$ h filter, and thicken with |
| 100  | „ Tragacanth (60:1000). Before use add                                               |
| 30   | „ Sodium Acetate cryst. and dilute to                                                |
| 1000 | parts.                                                                               |

### **Benzidine (or Tolidine) Brown.**

Naphthol Grounding 3 (see page 129).

|      |                                                                                                  |
|------|--------------------------------------------------------------------------------------------------|
| 18   | parts Benzidine Base (or 210 parts Tolidine Base); dissolve in                                   |
| 20   | „ Hydrochloric Acid 36° Tw and                                                                   |
| 100  | „ Boiling Water. Cool slowly and add                                                             |
| 200  | „ Ice and                                                                                        |
| 34   | „ Hydrochloric Acid 36° Tw. Cool to 32—40° F and add slowly                                      |
| 52   | „ Sodium Nitrite sol. (290 parts per 1000 parts Water). After 15 min. filter, and before use add |
| 40   | „ Sodium Acetate cryst., thicken with                                                            |
| 100  | „ Tragacanth (60:1000) and dilute with water to                                                  |
| 1000 | parts.                                                                                           |

### **Dianisidine-Naphthol Blue (from Dianisidine Salt).**

Naphthol Grounding 7 and 8 (see page 130).

#### **Medium Blue.**

|      |                                                                                                             |
|------|-------------------------------------------------------------------------------------------------------------|
| 8,3  | parts Dianisidine Salt, dry; make into a paste with                                                         |
| 5    | „ Hydrochloric Acid 36° Tw and                                                                              |
| 20   | „ Hot Water. Cool by adding                                                                                 |
| 100  | „ Ice Water, and at 32—40° F add                                                                            |
| 14   | „ Sodium Nitrite sol. (290 parts per 1000 parts Water). After 10 min. filter and mix, whilst stirring, with |
| 75   | „ Flour-Tragacanth Thickening (s.p.126). Add                                                                |
| 30   | „ Cupric Chloride 77° Tw and before use                                                                     |
| 2    | „ Chromic Acid dissolved in water. Dilute to                                                                |
| 1000 | parts.                                                                                                      |

#### **Azophor Blue D pat.**

Naphthol Grounding 7 and 8 (see page 130).

#### **Medium Blue.**

|      |                                              |
|------|----------------------------------------------|
| 25   | parts Azophor Blue D pat., dissolve in       |
| 800  | „ Water, filter and thicken with             |
| 75   | „ Flour-Tragacanth Thickening (s.p.126). Add |
| 30   | „ Cupric Chloride sol. 77° Tw and            |
| 1    | „ Chromic Acid dissolved in Water. Dilute to |
| 1000 | parts.                                       |

The Copper Chloride solution 77° Tw can be substituted with advantage by Copper solution N, 100 parts of which equal 40 parts of the Copper Chloride.

#### Copper solution N.

|             |                       |
|-------------|-----------------------|
| 160 parts   | Copper Chloride solid |
| 42.6 „      | Copper Acetate cryst. |
| 80 „        | Sodium Nitrite cryst. |
| 66 „        | Acetic Acid           |
| 1000 parts. |                       |

#### Mixed Diazo-compounds.

The Azophor Colours can be used for producing mixed shades; they are more suitable for this purpose than the ordinary Diazo-solutions on account of their greater stability.

#### Developing bath for Brown.

|   |             |                                                                      |
|---|-------------|----------------------------------------------------------------------|
| { | 20 parts    | Azophor Red PN pat.                                                  |
|   | 20 „        | Azophor Black S pat. are made into a paste with water and diluted to |
|   | 500 „       |                                                                      |
|   | 50 „        | Tragacanth 60:1000 are added; then slowly                            |
|   | 30 „        | Acetate of Soda cryst.;                                              |
|   | 300 „       | Water;                                                               |
|   | 15 „        | Soda Lye 36° Tw; and before dyeing                                   |
|   | 30 „        | Copper Solution N (see above) and                                    |
|   | 70 „        | Water are added                                                      |
|   | 1000 parts. |                                                                      |

#### Developing bath for Blue.

|   |             |                                                                      |
|---|-------------|----------------------------------------------------------------------|
| { | 10 parts    | Azophor Blue D pat.                                                  |
|   | 15 „        | Azophor Black S pat. are made into a paste with water and diluted to |
|   | 500 parts.  | — Then                                                               |
|   | 50 „        | Tragacanth 60:1000 and                                               |
|   | 40 „        | Acetate of Soda cryst.                                               |
|   | 300 „       | Water are added, and finally before dyeing                           |
|   | 30 „        | Copper Solution N (see above) and                                    |
|   | 70 „        | Water                                                                |
|   | 1000 parts. |                                                                      |

### 8. Sulphur Colours.

For producing Discharge effects upon Melanogen Blue the pieces are dyed as described on page 55 either in rope form or on the Jigger in a concentrated bath; a good blue is obtained with:

- 5% Melanogen Blue B pat
- 2% Soda calc. with the addition of
- 20 parts of Common Salt or Glauber's Salt to every 1000 parts of liquid.

The pieces are dyed at 176—194° F for 1 h, then rinsed and fixed. Small amounts of basic dyestuffs may be added to the fixing bath for shading purposes.

|                              | I.    | II.  | III.  | IV.   |
|------------------------------|-------|------|-------|-------|
| Alum                         | 4%    | 4%   | —     | —     |
| Fixing Salt M                | —     | —    | 4%    | 4%    |
| Acetic Acid 12° Tw.          | 2%    | 2%   | 2%    | 2%    |
| Violet cryst. O              | 0,25% | 0,1% | 0,25% | 0,15% |
| Brilliant Green cryst. extra | —     | 0,1% | —     | 0,05% |

The colour is fixed at a temperature of at least 140° F in  $\frac{1}{2}$  h, then the pieces are washed and dried over clean drying cylinders. The discharge effects are produced according to directions given on page 178.

## 4. Resist and Discharge Colours.

### 1. Resists and Discharges for basic dyestuffs.

a) Discharge effects upon tannin mordanted material, which is to be dyed afterwards with basic dyestuffs, by means of strong alkali-discharges.

The bleached material is padded in a warm Tannin-bath 140° F containing 15—20 parts of Tannin per 1000 parts of liquid, then dried in the hotflue; fixed in the usual manner with Tartar Emetic (10 parts per 1000), washed well, dried, and finally printed with Discharge White.

The drying after passing the pieces through Tannin can be dispensed with, if the goods remain lying rolled up wet for several hours, before fixing with Tartar Emetic.

Discharge White printing paste (Standard).

|          |                         |
|----------|-------------------------|
| 25 parts | Wheat Starch powder     |
| 75       | „ British Gum           |
| 900      | „ Soda lye 77° Tw       |
| 1000     | parts heated to 194° F. |

Reducing paste.

|           |             |
|-----------|-------------|
| 250 parts | British Gum |
| 750       | „ Water     |
| 1000      | parts.      |

According to the depth of the engraving the standard discharge colour is reduced from 2:1 to 1:2. If the pieces, which have been printed with the alkali-discharge-white, are printed before steaming with Steam-Aniline-Black, the latter will also be discharged at those places, that contain the alkali-white-discharge; (this acting as a Resist for the developing of the Black). After printing and drying, the pieces are passed for  $\frac{1}{2}$ —1 min. through the Mather Platt quick steaming apparatus at 210—212° F, then through Sulphuric Acid of 2° Tw and finally washed.

In order to obviate „doctor-streaks“ it is advisable to pad the pieces before printing with Chloride of Ammonia (10—20 parts



The white material (or pieces, which have been dyed with direct Colours) is printed with the Resist Colour; then printed or padded with basic dyestuffs (containing some tannin). Then steamed for 1 h without pressure, finally passed through Tartar Emetic, washed and soaped.

#### Tartar Emetic Resist.

|       |        |                      |     |
|-------|--------|----------------------|-----|
| 250   | parts  | British Gum          | 1:1 |
| 100   | „      | Water                |     |
| 250   | „      | China Clay           |     |
| 200   | „      | Sodium Tartar Emetic |     |
| 200   | „      | Sulphate of Zinc     |     |
| <hr/> |        |                      |     |
| 1000  | parts. |                      |     |

Coloured Tartar Emetic Resists are produced by adding to the above Resist: Chrome Yellow, Chrome Orange, Guignet Green, together with some Albumen and Ammonia.

#### Resist, containing Oxalate of Antimony.

|         |        |                  |
|---------|--------|------------------|
| 500     | parts  | Gum sol.         |
| 150     | „      | Antimony Oxalate |
| 20—50   | parts  | Citric Acid      |
| 330—300 | parts  | Water            |
| <hr/>   |        |                  |
| 1000    | parts. |                  |

This strong Resist has also resisting power for Alizarine-steam Colours, which might have been employed along with the other dyestuffs.

If the Tartar Emetic Resists are mixed with Tin Discharge Colours, these combined Antimony Tin-printing pastes can be used for producing discharge effects upon material, which has been dyed with direct dyeing Colours.

### c) Discharge effects, by means of oxidising Discharge Colours.

With Chlorate discharges white and coloured effects are obtained on certain Tannin Colours. The well bleached material is padded with a liquid containing 15—20 parts (per 1000) of Tannin at 140° dried; the Tannin is then fixed in the usual manner with Tartar Emetic 5—10 parts per 1000, and after washing the material dyed with basic dyestuffs. Chlorate Discharges printed upon thus dyed material produce white effects. For coloured effects Discharge lakes with Albumen solution are added to the Chlorate Discharge paste, or also certain basic colours, which withstand the oxidising action of the Chlorate paste. (Table 179).

According to the strength of the Chlorate Discharge the pieces are steamed either in the Mather Platt for 1—3 min. or for a longer time in the steam box.

In order to prevent the fibre from becoming tender and also to obtain a good discharge, it is advisable to alter the guiding rollers of the steaming apparatus, in a manner, that the pieces scarcely touch the hot copper rollers. This is more fully described on page 175 under „Tannin Resist styles of the insoluble Azo Colours“.

After steaming, the pieces are washed, then passed through a bath (104° F) containing 10 parts of Caustic Soda 77° Tw per 1000, washed again and dried. This operation acts favourably upon the purity of the white.

The following Chlorate Discharges are suitable for discharging Tannin Colours (Chlorate of Alumina being especially recommended for dark shades).

#### Chlorate Discharge.

|             |                    |
|-------------|--------------------|
| 300 parts   | British Gum powder |
| 420 "       | Water              |
| 200 "       | Chlorate of Soda   |
| 50 "        | Yellow Prussiate   |
| 30 "        | Citrate of Ammonia |
|             | 52½° Tw.           |
| 1000 parts. |                    |

#### Alumina-Chlorate Discharge I.

|             |                     |
|-------------|---------------------|
| 220 parts   | British Gum powder  |
| 50 "        | Water               |
| 20 "        | Red Prussiate       |
| 150 "       | Chlorate of Soda    |
| 560 "       | Chlorate of Alumina |
|             | 42° Tw              |
| 1000 parts. |                     |

#### Chlorate Discharge (Vanadium).

|             |                     |
|-------------|---------------------|
| 250 parts   | British Gum powder  |
| 500 "       | Water               |
| 10 "        | Red Prussiate       |
| 200 "       | Chlorate of Soda    |
| 30 "        | Citric Acid         |
| 10 "        | Vanadium sol. 1:100 |
|             | (page 127)          |
| 1000 parts. |                     |

#### Alumina-Chlorate Discharge II.

|             |                      |
|-------------|----------------------|
| 150 parts   | Chlorate of Soda     |
| 200 "       | Chlorate of Barium   |
| 250 "       | Water                |
| 40 "        | Flour. Boil and add  |
|             | at 122° F            |
| 130 "       | Sulphate of Alumina  |
| 120 "       | Water. Then add cold |
| 110 "       | Red Prussiate        |
| 1000 parts. |                      |

#### Chlorate of Alumina 42° Tw.

|    |                                 |                |
|----|---------------------------------|----------------|
| I  | { 200 parts Sulphate of Alumina | } dissolve hot |
|    | { 130 " Water                   |                |
| II | { 300 " Chlorate of Barium      | }              |
|    | { 350 " Water.                  |                |

I and II are mixed, cooled down, drawn off and made to twaddle at 42°.

The following Tannin Colours are discharged by the Chlorate Discharge pastes.

In dark shades.

**Auramine**, all brands, pat.

**Chrysoidine**, **Vesuvine**, **Cutch Brown**, **Dark Brown**, **Leather Brown**, **Leather Black**, **Coal Black**, all brands, **Brown A**; these dyes cannot be especially recommended on account of the great alteration which they undergo by the subsequent treatment (alkaline baths, dry chlorine).

**Azo Phosphine GO** pat., **Phosphine** and **Yellow for Leather**, all brands.

**Magenta**, all brands, **Acetate of Magenta**, **New Magenta O**, pat.

**Cerise**, **Grenadine**, **Maroon**, **Cardinal**, all brands.

**Brilliant Green**, **Malachite Green**, all brands.

**Methyl Violet, New Violet**, all brands.

**Violet crystals O, Fancy Violet O, Star Violet O.**

**Victoria Blue B.**

**Ethyl Blue**, all brands.

**Janus Yellow G, R, pat., Janus Red B pat., Janus Blue R, G, pat.**

**Indophene Blue R, G, pat.**

In medium and light shades.

**Rosazeine**, all brands.

**Safranine, Methylene Violet**, all brands.

**Methylene Heliotrope O.**

**Methylene Blue**, all brands, **Thionine Blue GO, Methylene Indigo**, all brands.

**Methylene Green**, all brands.

**Methylene Grey**, all brands.

**Janus Green B, pat., Janus Grey B, BB, Janus Darkblue R, pat.**

On easily dischargeable light grounds several colours, which are only discharged with difficulty, can be added to the Chlorate Discharge paste for producing a coloured effect f. i. Methylene Blue. Oxydianil Yellow withstands even very strong Chlorate Discharges and is therefore especially suitable for this purpose. Also Safranine, Rosazeine 4G, Methylene Heliotrop O may be used.

#### d) Discharge-effects by means of reducing discharges.

##### Zinc-dust discharges.

The following colours are destroyed by a Zinc-dust discharge print.

**Azophosphine, Magenta, Methyl Violet, Violet crystals, Malachite Green, Brilliant Green.**

These discharges, however, do not produce a pure white, and are therefore more suitable for coloured discharge-effects. For this purpose, are added to the zinc-dust discharge:

**Auramine, Phosphine, Rosazeine, Safranine, Methylene Heliotrop, Methylene Blue, Ethyl Blue, Methylene Green, Primuline.**

The material is dyed in the usual manner on tannin mordant; then printed with a coloured discharge; steamed under slight pressure for one hour; passed through cold, diluted sulphuric acid, (1—2 parts per 1000); washed and dried.

##### Coloured discharge.

|          |                                                                 |
|----------|-----------------------------------------------------------------|
| 20 parts | of colour                                                       |
| 130      | „ Water                                                         |
| 50       | „ Ethyl-Tartaric acid 22° Tw, add cold                          |
| 400      | „ British gum-thickening 1:1, finely ground with                |
| 300      | „ Zinc-dust; into the whole, are stirred slowly, whilst cooling |
| 100      | „ Bi-sulphite of Sodium 66½° Tw                                 |
| 1000     | parts.                                                          |

## Sulphite discharges.

Several colours dyed on tannin mordant in light shades can be discharged with sulphite colours:

**Brilliant Green, Malachite Green, Methylene Blue, Methylene Green, Magenta, New Magenta, Azo Phosphine.**

## Sulphite white Discharge I.

|       |        |                       |         |
|-------|--------|-----------------------|---------|
| 550   | parts  | Sulphite of Potassium | 91° Tw. |
| 250   | „      | British gum           |         |
| 200   | „      | Water                 |         |
| <hr/> |        |                       |         |
| 1000  | parts. |                       |         |

In order to produce coloured discharge effects, the following dyestuffs may be added to the Sulphite white Discharge:

**Auramine, Phosphine, Methyl Violet, Safranine, Methylene Heliotrop, Methylene Violet, Victoria Blue, Ethyl Blue, Rosazeine.**

If free alkali is added to the Sulphite white Discharge, even Auramine, and Rosazeine 4G can be discharged.

## Sulphite white Discharge II.

|       |        |                            |        |
|-------|--------|----------------------------|--------|
| 550   | parts  | Sulphite of Potassium      | 91° Tw |
| 130   | „      | Sulphocyanide of Potassium |        |
| 50    | „      | Soda Lye                   | 77° Tw |
| 250   | „      | British Gum                |        |
| 20    | „      | Water                      |        |
| <hr/> |        |                            |        |
| 1000  | parts. |                            |        |

The Sulphite Discharges are printed on the dyed material, the latter then steamed for 1—3 minutes in the Mather-Platt, washed, and chlorinated.

## Protoxide of Tin-sodium Discharge.

The Discharge white described on page 158 can be used for the following colours in light shades:

**Auramine, Azo Phosphine GO, Rosazeine, Magenta, Methyl Violet** (reddish brands), **Malachite Green, Brilliant Green;** whereas **Victoria Blue** and **Safranine** resist the Discharge well.

## Sodium Discharge.

For this purpose, caustic soda 76.6° Tw, thickened with British gum and Wheat-starch (see Alkaline Thickening on page 158), is used. Still better results are obtained, if the dyed material is either prepared before printing with a Glucose solution, or the glucose is added to the printing-paste.

The sodium Discharge acts similarly to the Protoxide of Tin sodium Discharge.



## 2. Resist and Discharge-effects on mordant colours.

### a) Discharging the mordants with organic acids and subsequent dyeing.

#### White Discharge on alumina-mordanted material.

In order to produce a Discharge-effect on an Alumina mordant, Alumina padding-liquid, described on page 137 is used; the padded and dried material is then printed with Discharge white, which contains principally citric or tartaric acid, either alone, or mixed with their alkali salts, or sometimes acid sulphate; the mordant is then fixed as described on pages 137 and 138, by hanging, or short steaming, and boiling-off. The further treatment resembles that described on page 137.

#### Discharge White.

|             |                  |
|-------------|------------------|
| 800 parts   | Gum Solution 1:1 |
| 100 „       | Tartaric Acid    |
| 100 „       | Citric Acid      |
| 1000 parts. |                  |

The following colours are used for dyeing discharged alumina mordants:

**Alizarine Orange**, all brands.

**Alizarine Red**, all brands with exception of "S" brands.

**Alizarine Brown** paste.

**Alizarine Claret R** paste.

#### White discharge on chrome-mordanted material.

The material is prepared with light chrome-mordant, as described on pages 138 and 139; the white Discharge is then printed together with the dark chrome colour, and the pieces dyed with Alizarine colours, as described previously.

#### Discharge White I.

|            |                  |
|------------|------------------|
| 1000 parts | Gum solution 1:1 |
| 10 „       | Citric acid      |
| 9 „        | Tartaric Acid.   |

In order to discharge dark shades, Discharge white II, or Discharge white V, (page 157) is used.

#### Discharge White II.

|            |                  |
|------------|------------------|
| 1000 parts | Gum solution 1:1 |
| 90 „       | Citric Acid      |
| 60 „       | Tartaric acid.   |

After printing, the pieces are steamed for 5 minutes, then passed through soda, 30 parts per 1000 parts, at 122° F. well washed, and dyed.

For dyeing discharged chrome mordants, the colours mentioned on pages 139 and 140, also Solid Green O are used.

### White Discharge on Iron mordant dyed with Solid Green.

The material is padded with the iron mordant (page 140), then printed with Discharge white, fixed in the usual manner, and dyed with Solid Green O 50%, or with Alizarine colours.

### b) Resists under Alizarine Steam-colours.

The ingredients used for Resists are: citric acid, tartaric acid, oxalic acid, and their alkali salts, also oxalate of antimony, the latter is also suitable for Resists under Tannin colours. The resist-colours are mostly printed on cloth prepared with Turkey red oil, then over-printed with Alizarine colours. The pieces are then steamed for 1-1½ hours without pressure, passed through chalk, washed and soaped.

### Resists for Steam Alizarine Pink and Steam Alizarine Violet.

|             |                        |
|-------------|------------------------|
| 300 parts   | British Gum            |
| 600 „       | Water                  |
| 30 „        | Citric acid            |
| 50 „        | China Clay             |
| 20 „        | Citrate of Soda 48° Tw |
| 1000 parts. |                        |

### c) Discharging the steam padding-liquids prepared from mordant colours.

The steam padding-effects which are produced as described on pages 47-51, and page 140, according to the one- or two-bath method, with Alizarine colours, can be discharged with organic acids, or their alkali salts, also with oxalate of antimony, or lastly, with oxidizing Discharges.

The Discharge made with oxalate of Antimony can serve simultaneously for Resist under Tannin colours. The oxidizing Discharges are especially employed for Alizarine chrome padding colours.

The strength of the Discharge is regulated by the depth of the dyed shades.

The Discharges are printed on the padded material, which is then steamed, either in the Mather-Platt, or in a closed steam-box, and finally washed and soaped in the manner usually employed for Alizarine steam-colours.

### Discharge White I.

|             |                  |
|-------------|------------------|
| 800 parts   | Gum Solution 1:1 |
| 100 „       | Tartaric Acid    |
| 100 „       | Citric Acid      |
| 1000 parts. |                  |

To be applied in the reduced state ¼-¼.

## Discharge White II.

|       |        |                        |        |
|-------|--------|------------------------|--------|
| 700   | parts  | British Gum Thickening | 1:1    |
| 200   | „      | Soda Lye               | 67° Tw |
| 100   | „      | Citric Acid            |        |
| <hr/> |        |                        |        |
| 1000  | parts. |                        |        |

## Discharge White III.

|       |        |                     |     |
|-------|--------|---------------------|-----|
| 850   | parts  | Gum Solution        | 1:1 |
| 150   | „      | Oxalate of Antimony |     |
| <hr/> |        |                     |     |
| 1000  | parts. |                     |     |

## Discharge White IV.

|       |        |                     |     |
|-------|--------|---------------------|-----|
| 840   | parts  | Gum Solution        | 1:1 |
| 120   | „      | Oxalate of Antimony |     |
| 40    | „      | Tartaric Acid       |     |
| <hr/> |        |                     |     |
| 1000  | parts. |                     |     |

The following Discharge White V produces a very pure White even under Aniline Black.

## Discharge White V.

|       |        |                       |        |
|-------|--------|-----------------------|--------|
| 200   | parts  | British Gum           |        |
| 600   | „      | Sulphite of Potassium | 90° Tw |
|       |        | heat and add cold     |        |
| 200   | „      | Citrate of Ammonia    | 46° Tw |
| <hr/> |        |                       |        |
| 1000  | parts. |                       |        |

Besides the Chlorate Discharges given on page 152, the following discharge, prepared with Discharge Salt I and II, can be used:

## Discharge White VI.

|       |        |                              |     |
|-------|--------|------------------------------|-----|
| 400   | parts  | Gum Solution                 | 1:1 |
| 120   | „      | Sodium Chlorate              |     |
| 408   | „      | Discharge Salt I (M. L. B.)  |     |
| 72    | „      | Discharge Salt II (M. L. B.) |     |
| <hr/> |        |                              |     |
| 1000  | parts. |                              |     |

Steam padding-colours prepared with Solid Green O, are discharged with Sulphite Discharges. The Discharges are printed on the Solid Green padded material, steamed for one hour without pressure, well washed, and soaped. For coloured resists, direct-dyeing colours, or chrome-lakes of mordant colours, such as Alizarine Blue SB, and Ceruleine, are suitable.

## Discharge White.

|       |        |                                |        |
|-------|--------|--------------------------------|--------|
| 100   | parts  | Kaoline made into a paste with |        |
| 83    | „      | Water                          |        |
| 375   | „      | Sulphite of Potassium          | 90° Tw |
| 75    | „      | Bisulphite of Soda             | 64° Tw |
|       |        | stirred into                   |        |
| 250   | „      | British Gum powder             |        |
| 117   | „      | Citrate of Soda                | 53° Tw |
| <hr/> |        |                                |        |
| 1000  | parts. |                                |        |

## Coloured Discharges for Solid Green-Brown.

|                              |                    |                    |                    |
|------------------------------|--------------------|--------------------|--------------------|
| Aurophenine O                | 30 parts           | — parts            | — parts            |
| Diamine Pure Blue            | — „                | 20 „               | 9 „                |
| Dianil Yellow 3G             | — „                | — „                | 20 „               |
| Water                        | 445 „              | 455 „              | 446 „              |
| British Gum powder           | 300 „              | 300 „              | 300 „              |
| Sulphite of Potassium 90° Tw | 190 „              | 190 „              | 190 „              |
| Bisulphite of Soda 64° Tw    | 35 „               | 35 „               | 35 „               |
|                              | <u>1000 parts.</u> | <u>1000 parts.</u> | <u>1000 parts.</u> |

## d) Discharging Mordant Colours.

## Discharging Turkey Red by means of Chloride of Lime.

The dyed material is printed with thickened organic Acids: Citric, or Arsenic and Citric Acid for Discharge White; Citric Acid and Lead salts for Discharge Yellow; Tartaric Acid and a solution of Prussian Blue in Oxalic Acid for Discharge Blue. By mixing Discharge Yellow and Blue, Discharge Green is obtained. After printing, the goods are passed through a series of cisterns, the first of which contains strong Chloride of Lime solution (100 parts Chloride of Lime per 1000 parts of water), and the others running water. After the passage through Chloride of Lime, which effects the discharging, the Yellow and Green are developed in a lukewarm weak Chrome bath. Instead of Citric, Oxalic and Tartaric Acid, Lactic Acid may be used with advantage (C. F. Boehringer & Sons, Nieder Ingelheim a. Rh.).

Discharging Turkey Red by means of the  
Glucose-alkali method.

This process is founded upon the Schlieper-Baum Discharge styles (Indigoprints upon Turkey Red).

1. Preparing the goods, dyed with Turkey Red, with a strong Glucose solution, and drying.
2. Printing strong alkaline Colours.

For White: Concentrated Caustic Soda is thickened with Dextrine, and Sodium Protoxide of Tin and Silicate of Sodium added.

## Discharge White.

100 parts Tin Salt Ia cryst are added at a temperature not exceeding 95° F to

700 „ Alkaline Thickening, then

200 „ Silicate of Soda 72—77° Tw are added

1000 parts.

## Alkaline Thickening.

26 parts Wheat Starch

78 „ British Gum

896 „ Soda Lye 100° Tw

1000 parts.

For Blue: To the above Discharge White Indigo paste is added. For Yellow: The above Discharge White is mixed with Sodium-Lead Oxide. For Green: Mixture of Yellow and Blue.

After printing the goods are well dried and at once steamed in the Mather Platt with powerful steam for 2—3 min. The steamed pieces are then passed through a boiling bath of Sodium Silicate (20 per 1000); washed, chromed in an acidified Chrome bath, washed again and dried.

In order to simplify the method, the preparation with Glucose can be dispensed with if the Glucose is added to the Discharge pastes. These discharge colours, however, are only stable for a short time.

### Discharging Mordant Colours by means of Chlorate Discharge.

Alizarine Colours dyed upon Chrome mordanted material can be discharged by printing Chlorate Discharges (page 152), the pieces are then steamed for 1—3 min. in the Mather-Platt, passed through Chalk, washed and soaped.

The chrome-lakes of the following colours can be discharged by Chlorate Discharges:

**Alizarine Orange**, all brands.

**Alizarine Red**, all brands (with the exception of the „S“ brands).

**Alizarine Claret R** paste.

**Alizarine Brown**, all brands.

**Alizarine Blue**, all „S“ brands, powder and paste.

**Alizarine Green S**, powder and paste.

**Galleine**, all brands.

**Ceruleine**, all brands.

**Solid Green O** 50 % paste.

## 3. Discharging direct Colours.

### a) Tin Salt Discharges.

The following Dianil Colours are discharged:

#### a) white discharge effect:

**Cresotine Yellow G**, **Aurophenine O**, **Dianil Orange N**, **Dianil Red R**, 4B, 10B, **Brilliant Dianil Red R**, **Delta Purpurine 5B**, **Dianil Claret Red G**, B, **Dianil Brown 3GO**, 2G, BD, **Dianil Blue 2R**, R, B, G, pat., **Dianil Darkblue R** pat., **Dianil Black B**, R, G, pat. Eventually with Solidogen-after-treatment.

#### b) coloured discharge effect:

All Dianil Colours with exception of the Dianil Yellows.

The bleached material is dyed in the usual manner, printed with white or coloured Tin Discharges and steamed. The steaming is varied from 3—10 min. or even longer, according to the depth of the original shade and to the strength of the Discharge. Discharges

containing Tin Salt and free Acid, besides the required amount of Acetate of Tin, must not be steamed too long and always with care, lest the fibre is affected. In most cases the Mather Platt quick steaming apparatus is used for this purpose. The longer the steaming lasts the more the white is changed towards yellow. Then the pieces are washed and, to improve the white, slightly soured if this is possible.

In many cases it is advisable to pass the steamed goods through a Solidogen solution. This aftertreatment improves on the one hand the fastness to Acids (Dianil Red 4B) and on the other hand the fastness to washing (Dianil Blue); moreover the white is improved and in some cases the beauty of the shade enhanced. This aftertreatment is best executed at full width.

### Tin salt White Discharges.

#### White Discharge I.

|     |       |                        |
|-----|-------|------------------------|
| 450 | parts | Acid Starch (page 126) |
| 275 | „     | Tin Crystals Ia        |
| 75  | „     | Acetic Acid 12° Tw     |
| 125 | „     | Acetate of Soda Cryst. |
| 75  | „     | Tragacanth 60:1000.    |

1000 parts.

Suitable for short steaming.

#### White Discharge II.

|     |       |                               |
|-----|-------|-------------------------------|
| 80  | parts | Wheat Starch                  |
| 80  | „     | Water                         |
| 250 | „     | Dextrine                      |
| 550 | „     | Acetate of Tin 32° (page 162) |
| 40  | „     | Citric Acid                   |

1000 parts.

Suitable for longer steaming.

#### White Discharge III.

|     |       |                               |
|-----|-------|-------------------------------|
| 110 | parts | Wheat Starch                  |
| 850 | „     | Acetate of Tin 32° (page 162) |
| 50  | „     | Acetic Acid 12° Tw            |

1000 parts. Boil well.

Suitable for long steaming. To improve the white which has the tendency to turn yellow after steaming, the material must be soured in the usual way.

#### White Discharge IV.

|     |       |                          |
|-----|-------|--------------------------|
| 400 | parts | Acid Starch (page 126)   |
| 100 | „     | Tragacanth (60:1000)     |
| 240 | „     | Tin crystals Ia          |
| 110 | „     | Water                    |
| 100 | „     | Sulphocyanide of Ammonia |
| 50  | „     | Citric Acid 36° Tw       |

1000 parts.

Even when reduced, No. IV discharges very effectually and produces a very good white.

White Discharge V.

|      |        |                             |
|------|--------|-----------------------------|
| 40   | parts  | Wheat Starch                |
| 290  | "      | Water                       |
| 100  | "      | British Gum                 |
| 320  | "      | Protoxide of Tin paste      |
| 150  | "      | Tartrate of Ammonia 32° Tw. |
| 100  | "      | Sal-Ammoniac.               |
| 1000 | parts. |                             |

Protoxide of Tin paste.

|    |   |       |       |                              |
|----|---|-------|-------|------------------------------|
| I  | { | 695   | parts | Tin crystals Ia dissolved in |
|    |   | 10000 | "     | Water                        |
| II | { | 475   | "     | Soda                         |
|    |   | 10000 | "     | Water.                       |

Stir II into I, wash the precipitate once, filter by decanting and make up to 2000 parts.

Tartrate of Ammonia 32° Tw.

|           |       |                                           |
|-----------|-------|-------------------------------------------|
| 1000      | parts | Tartaric Acid are dissolved in            |
| 1500      | "     | Hot Water, and to this are added at 86° F |
| 1000/1200 | parts | Ammonia. (The solution is alkaline).      |

Make up with water to 32° Tw.

White Discharge V can also be used for long steaming and may be employed to produce coloured discharges containing lakes which are fixed with albumen.

Coloured Tin Salt Discharges.

1. With basic dyestuffs.

The following colours can be added to the discharge pastes:

**Auramine, Phosphine, Magenta, Methyl Violet, Brilliant Green, Malachite Green, Methylene Blue, Marine Blue, Methylene Grey, Methylene Heliotrop, Ethyl Blue, Rosazeine 4G pat., Victoria Blue.**

Coloured Discharge No. I.

|      |        |                                           |
|------|--------|-------------------------------------------|
| 30   | parts  | Colouring matter                          |
| 230  | "      | Acetic Acid 9° Tw                         |
| 250  | "      | Acid Starch (page 126)                    |
| 40   | "      | Tartaric Acid                             |
| 150  | "      | Acetic Acid Tannin Solution 1:1. Then add |
| 300  | "      | Standard White                            |
| 1000 | parts. |                                           |

Standard White.

|   |      |        |                                                   |
|---|------|--------|---------------------------------------------------|
| { | 368  | parts  | Acetate of Tin 32° Tw                             |
|   | 148  | "      | British Gum                                       |
|   | 74   | "      | Gum Solution 1:1                                  |
|   | 37   | "      | Citric Acid                                       |
|   | 40   | "      | Water. Boil for 10 min. then add                  |
|   | 222  | "      | Tin cryst. Ia. Stir for 5 min.; after cooling add |
| { | 37   | "      | Sodium Acetate cryst.                             |
|   | 74   | "      | Water                                             |
|   | 1000 | parts. |                                                   |

## Acetate of Tin 32° Tw.

|            |                     |   |                |
|------------|---------------------|---|----------------|
| 1000 parts | Tin crystals Ia     | } | dissolved hot. |
| 800        | „ Acetic Acid 9° Tw |   |                |
| 1000       | „ Sugar of Lead     | } | „ „            |
| 800        | „ Acetic Acid 9° Tw |   |                |

The Tin solution is poured into the Lead solution the precipitate cooled and filtered, and the clear solution made up with Acetic Acid 9° Tw to 32° Tw. Another method is to dissolve Protoxide of Tin (commercial paste) in Acetic Acid Anhydride.

## 2. With Pigment Colours.

## Coloured Discharge No. 2.

|             |                                |
|-------------|--------------------------------|
| 200 parts   | Chrome Yellow paste            |
| 100         | „ Albumen 1:1                  |
| 700         | „ Discharge White V (page 161) |
| 1000 parts. |                                |

## Solidogen aftertreatment.

The discharged pieces are passed after steaming at full width for  $\frac{1}{2}$  min. through a bath containing 20 parts Solidogen A pat. and 5—10 parts of Muriatic Acid 36° Tw per 1000; they are then washed, eventually passed for  $\frac{1}{2}$  min. through a weak, cold soda bath (5—10 parts per 1000) and washed again.

## b) Zinc dust discharges.

The following Dianil Colours are discharged with Zinc dust discharges:

a) white Discharge effects are produced upon all colours named under “a” for Tin Discharges (page 159).

b) coloured Discharge effects are obtained upon all colours named under “b” page 159.

The Zinc dust discharges are superior to Tin Discharges on account of their more energetic action and because they do not impair the cotton fabric at all. On the other hand the selection of colours suitable for producing coloured Zinc dust Discharges is considerably more limited than those suitable for coloured Tin Discharges. Moreover the Zinc dust discharges are liable to stick in the engraving and only the finest powder, pasted with water, is suitable for printing. It is necessary to use brush-furnishers in printing. The Zinc Dust discharges are made up with Zinc Dust, Bisulphite and Gum or Dextrine thickening and contain mostly additions of Glycerine, Soda-solution, Ammonia or other ingredients which increase the stability of the printing colour, viz Formic Aldehyde, Acet aldehyde, Aceton.

## White Discharge I.

|             |                            |
|-------------|----------------------------|
| 250 parts   | Zinc Dust, finest powder   |
| 500         | „ Gum Solution 1:1         |
| 50          | „ Glycerine                |
| 50          | „ Ammonia                  |
| 150         | „ Sodium Bisulphite 66° Tw |
| 1000 parts. |                            |



## White Discharge II.

|   |      |        |                                                                   |
|---|------|--------|-------------------------------------------------------------------|
| { | 250  | parts  | Zinc Dust finest powder                                           |
| { | 200  | „      | Gum solution 1:1; grind thoroughly and add whilst cooling         |
|   | 400  | „      | Sodium Bisulphite 66° Tw. After the reaction has taken place, add |
| { | 30   | „      | Soda                                                              |
| { | 70   | „      | Water                                                             |
| { | 50   | „      | Glycerine are added                                               |
|   | 1000 | parts. |                                                                   |

## White Discharge III.

|   |      |        |                                                           |
|---|------|--------|-----------------------------------------------------------|
| { | 250  | parts  | Zinc Dust finest powder                                   |
| { | 230  | „      | Gum Solution 1:1, grind thoroughly and add whilst cooling |
|   | 400  | „      | Sodium Bisulphite 66° Tw                                  |
|   | 70   | „      | Formaldehyde 40%                                          |
|   | 50   | „      | Glycerine                                                 |
|   | 1000 | parts. |                                                           |

The following dyes may be added to the coloured zinc dust discharges: **Oxydianil Yellow O**, **Phosphine**, **Safranine**, **Methylene Heliotrop** and **Rosazeine**.

## c) Oxidation Discharges.

The following Dianil Colours can be discharged with Chlorate Discharges:

All Dianil Colours with the exception of **Dianil Yellow** and **Oxydianil Yellow**, a pure white is produced with **Cresotine Yellow**, **Toluylene Orange R**, **Dianil Orange N**, **Brilliant Dianil Red**, **Delta Purpurine 5B**, **Dianil Red**, **Dianil Claret Red** and **Dianil Blue**.

All Chlorate Discharges given on page 152 can be used. For coloured effects the following colours may be added to the Chlorate Discharge paste:

**Methylene Blue**, **Rosazeine 4G pat.**, **Oxydianil Yellow O**.

## 4. Discharges and Resists for Indigo.

On all Indigo dyed Blues discharge or resist effects can be produced. In rare cases the mercerizing effect of strong alkalies is also made use of. These so called mercerized effects are produced by printing before vat-dyeing the material.

## a) Indigo Discharge effects.

Indigo dyed material is discharged mostly by a process of oxidation; the following ingredients, together with caustic alkalies, are employed: **Chromates**, **Chlorates**, **Bromates** and **Red Prussiate salts**.

### 1. Chromate Discharge.

In using Chromates, Chromic Acid is liberated in passing the printed goods through Acid. This has a most energetic and destroying influence upon Indigo blue, but impairs the fibre at the same time, by converting it into Oxycellulose. In order to obviate this, organic substances are added to the hot acid bath: Alcohol, Glycerine, Leiogomme etc. which mitigate the Chromic Acid reaction to a certain extent. Oxalic Acid acts in a similar manner and is therefore almost always added to the Acid bath. It regulates the discharging and counteracts the superfluous Chromic Acid.

A considerable advantage is offered by Chromate Discharges, in as much as they can be used for the production of brilliant coloured Discharge effects on Indigoblue: Chrome Yellow, Chrome Orange, Vert Guignet, Vermillion, Ochre, Soot, also a series of lakes fast to acids and chrome can be used for this purpose; they are fixed with Albumen, which is coagulated and made sufficiently stable when passing the goods through the hot acid bath.

The Potassium or Sodium Bichromate, which is mostly used for these Discharges, is neutralized with Soda, caustic Soda or Ammonia. A slight surplus of ammonia is rather beneficial, since it enhances the consistency of the printing colours prepared with Albumen; in order to avoid frothing, some Turpentine is added to the pastes.

These albumen colours are liable to stick in the engraving, and therefore brush-furnishers are to be used; moreover the colours must be well ground and sieved.

The amount of Bichrome is regulated by the depth of the original blue shades and by the depth of the engraving. Coloured Discharges do not require as much discharging ingredient as White Discharges.

The following recipe is an example for a

#### Standard White Discharge.

|       |        |                             |
|-------|--------|-----------------------------|
| 180   | parts  | Bichrome                    |
| 376   | „      | hot Water, neutralized with |
| 64    | „      | Soda calc; then             |
| 280   | „      | burnt starch                |
| 200   | „      | Water                       |
| <hr/> |        |                             |
| 1100  | parts. |                             |

Heated to 140° F, cooled and sieved.

#### Coloured Discharge for Medium Blue.

|       |        |                           |
|-------|--------|---------------------------|
| 300   | parts  | Discharge Pigment         |
| 400   | „      | Thickening for Discharges |
| 300   | „      | Tragacanth (60:1000)      |
| <hr/> |        |                           |
| 1000  | parts. |                           |

## Thickening for Discharges.

|             |                           |
|-------------|---------------------------|
| { 320 parts | Tragacanth (60:1000)      |
| 100 „       | Bichromate of Potassium   |
| 130 „       | Hot Water;                |
|             | after dissolving add      |
| 50 „        | Ammonia 25% and when cold |
| 400 „       | Blood Albumen sol. 1:1    |
| <u>1000</u> | parts.                    |

As Discharge Pigments Chrome Yellow, Vermillion, Ochre, Vert Guignet and the commercial discharging lakes can be used.

For dark Indigo shades with Melanogen Blue bottom the following discharges may be employed:

## White Discharge.

|             |             |
|-------------|-------------|
| 200 parts   | Bichrome    |
| 470 „       | Water       |
| 80 „        | Solvay Soda |
| 250 „       | British Gum |
| <u>1000</u> | parts.      |

## Yellow Discharge.

|             |                         |
|-------------|-------------------------|
| 550 parts   | Chrome Yellow paste     |
| 150 „       | Tragacanth (60:1000)    |
| 150 „       | Albumen 1:1             |
| 150 „       | Yellow Chromate of Soda |
| <u>1000</u> | parts.                  |

## Red Discharge.

|             |                         |
|-------------|-------------------------|
| 550 parts   | Discharge Red Lake      |
| 150 „       | Tragacanth (60:1000)    |
| 150 „       | Albumen 1:1             |
| 150 „       | Yellow Chromate of Soda |
| <u>1000</u> | parts.                  |

After printing and drying the material is passed through the Acid bath at 140° F.

## Acid bath.

|          |                                       |
|----------|---------------------------------------|
| 50 parts | Sulphuric Acid 168 $\frac{1}{2}$ ° Tw |
| 50 „     | Oxalic Acid cryst.                    |
| 1000 „   | Water.                                |

The pieces are then washed well and dried.

For coloured effects upon Indigo discharge styles, the insoluble Azo Colours are also suitable. They are applied according to the Chromate or Prussiate discharging method. When using the former, the Indigo dyed material is naphtholated, the Chromate Discharge containing the Diazo Compounds printed, and the pieces then soured. Of the Diazo Compounds, that of the Amido-azo-benzene, (pat. Dr. W. Elbers) and that of the Para-nitro-diazo-benzene are suitable for this purpose: the latter especially in its stable form: Azophor Red PN pat.

## Naphtholgrounding.

|                              |       |                     |
|------------------------------|-------|---------------------|
| 25                           | parts | $\beta$ -Naphthol R |
| 50                           | „     | Soda Lye 36° Tw     |
| 25                           | „     | Para Soap PN        |
| <hr/> make up to 1000 parts. |       |                     |

## Discharge Red printing paste A.

|                   |       |                           |
|-------------------|-------|---------------------------|
| 270               | parts | Tragacanth (60:1000)      |
| 180               | „     | Sodium Bichromate         |
| 550               | „     | Azophor Red sol. 224:1000 |
| <hr/> 1000 parts. |       |                           |

## Azophor Red-solution 224:1000.

|   |     |       |                                        |
|---|-----|-------|----------------------------------------|
| { | 224 | parts | Azophor Red PN pat.                    |
| { | 600 | „     | Water. After dissolving filter and add |
| { | 100 | „     | Soda Lye 36° Tw                        |
| { | 300 | „     | Water.                                 |

In order to produce a pure White on Indigo by means of Chromate Discharges, together with insoluble Azo-Colours, the detrimental effect of Chromic Acid upon Beta Naphthol must be counteracted. For this purpose the pieces are washed before souring, until all the superfluous Beta Naphthol is removed and it is also necessary to use insoluble Chromates as discharging ingredients.

Camille Kurz and Felix Knnert have founded a method upon using a Naphtholgrounding containing Bichrome and White and Coloured Discharges containing sugar of lead. We, however, recommend the direct application of insoluble Chromates, especially the addition of Barium Chromate to the White and Coloured Discharges.

The Indigo dyed goods are naphtholated and printed with Discharge Colours containing Barium Chromate; then after drying the superfluous Naphthol is removed by carefully rinsing the pieces in diluted Ammonia (40 parts per 1000) and water; then the material is passed for 20 seconds through the Acid bath (50 parts Muriatic Acid 32 $\frac{1}{2}$ ° Tw and 50 p. Oxalic Acid in 1000 parts of liquid) at 176° F; then well washed and finally soaped in order to cleanse the Discharge Colours.

## Chrome Discharge White B.

|                   |       |                                             |
|-------------------|-------|---------------------------------------------|
| 150               | parts | Tragacanth (60:1000)                        |
| 250               | „     | Water and                                   |
| 600               | „     | Barium Chromate 80% paste are finely ground |
| <hr/> 1000 parts. |       |                                             |

## Chrome Discharge Red B.

|                   |       |                                     |
|-------------------|-------|-------------------------------------|
| 200               | parts | Tragacanth (60:1000),               |
| 100               | „     | Water                               |
| 300               | „     | Barium Chromate 80% paste           |
| 400               | „     | Azophor Red Sol. 224:1000, as above |
| <hr/> 1000 parts. |       |                                     |

## 2. Chlorate-Discharge.

The Chlorate Discharge is principally used if white effects only are to be produced; it is especially employed for heavy designs, since it is less liable to form Oxycellulose than the Chromate Discharge. In order to mitigate the oxidising reaction, part of the Chlorate is replaced by Bromate. The Indigo is destroyed in this method by steaming in the Mather-Platt and the Discharge pastes contain a certain amount of Red or Yellow Prussiate as carrier of the oxygen. The most powerful discharge is prepared with the very labile Alumina Chlorate. Additions of organic Acids or their Alkali or Ammonia salts act favourably upon the white; but care must be taken to avoid the slightest surplus of acid, since this will easily corrode the cotton fibre.

The Chlorate Discharges described on page 152 are suitable for printing upon Indigo bottom. Their strength must be regulated by and the pastes be reduced according to the depth of the shade.

We also wish to point out that several lake manufacturers make coloured steam-discharges, which produce very good results.

## 3. Prussiate-Discharge.

The Prussiate Discharge is only applicable to light and medium Indigo blues. This method is founded upon printing thickened Red Prussiate upon the material and passing the latter subsequently through caustic soda. If this method is combined with the production of insoluble Azo Colours, very brilliant and fast coloured discharges are obtained on Indigo bottom. For this purpose the Diazocompounds of p-Nitraniline, m-Nitraniline, Nitrotoluidine and Alpha Naphthylamine are suitable. The Indigo dyed material is padded with Naphthol-solution, dried, printed with the Discharge, passed for 10 seconds through a cold Discharging bath and finally washed and dried.

### Naphthol grounding.

|          |                 |
|----------|-----------------|
| 25 parts | Beta Naphthol   |
| 50 „     | Soda Lye 36° Tw |
| 25 „     | Para Soap PN    |
| 1000     | parts.          |

### Discharge Red P.

|           |                                             |
|-----------|---------------------------------------------|
| 400 parts | Paranitraniline Diazo solution (28:1000)    |
| 400 „     | Wheat Starch-Tragacanth Thickening (p. 126) |
| 160 „     | Red Prussiate, finely powdered,             |
| 40 „      | Sodium Acetate crystals.                    |
| 1000      | parts.                                      |

### Discharging bath.

|             |                 |
|-------------|-----------------|
| 10000 parts | Soda Lye 22° Tw |
| 100 „       | Solvay Soda.    |

## b) Indigo Resist Styles.

Resist styles are produced under Indigo by printing the Resist Colours (reserving pulps) and subsequently dyeing the pieces in the

Vat. The Resists contain oxidizing ingredients: coppersalts in conjunction with lead salts and also mechanical resisting agents such as Chinaclay, Barium Sulphate, fats etc. etc. together with thickenings made from Gum (in rarer cases Burnt Starch or Flour Thickening are also used). Besides White Resists also Yellow and Orange Resists are obtained by dyeing the printed white lead Resist with Chromates or by a subsequent treatment in a hot Lime bath. If the goods are slightly blued before printing, the White Resist will produce a light blue, the Yellow Resist a green effect upon a dark blue ground.

The pieces are mostly starched before printing; after dyeing they are dried and then soured and washed in the usual manner.

#### White Resist I.

|             |                            |
|-------------|----------------------------|
| 360 parts   | Gum sol. 1:1               |
| 30 "        | Acetate of Copper          |
| 30 "        | Sulphate of Copper         |
| 120 "       | Nitrate of Copper          |
| 60 "        | Water                      |
| 400 "       | Sulphate of lead paste 66% |
| 1000 parts. |                            |

#### White Resist II.

|             |                    |                              |
|-------------|--------------------|------------------------------|
| 200 parts   | Flour              | } boiled; when luke warm add |
| 585 "       | Water              |                              |
| 180 "       | Sulphate of Copper |                              |
| 25 "        | Nitrate of Copper  |                              |
| 10 "        | Tournant Oil       |                              |
| 1000 parts. |                    |                              |

If white and coloured effects are to be produced under Indigo, which is fixed by the Glucose process, the material is first prepared with Glucose, and then colours printed upon it, which contain finely divided sulphur flowers.

#### White Resist.

|             |                 |
|-------------|-----------------|
| 600 parts   | Gum sol. 1:1    |
| 400 "       | Sulphur flowers |
| 1000 parts. |                 |

The further treatment of the material is described on page 123.

### 5. Resist effects upon colours which are produced on the fibre by a process of oxidation.

#### Steam Aniline Black Resist styles.

(Prudhomme Black).

Resist effects under Aniline Black are produced with alkaline reducing agents: caustic alkalies, their Carbonates, Silicates, Sulphites, Oxide of Zinc, Carbonate of Magnesia, Sulphocyanides.

For coloured Resists are employed:

1. Basic Colours of series No. 1 (page 113) fixed with Tannin, or, without Tannin, with the addition of Acetate of Zinc, Zinc Oxide (and eventually Albumen).

2. Direct Colours of series No. 3 (page 114).

3. Colour lakes and pigment Colours fixed with Albumen.

The white and coloured Resists are printed either upon the undeveloped padded black, or upon the white material before padding.

Aniline black padding liquid and the treatment of the material are described on page 143.

Resists upon undeveloped padded Aniline Black.

White Resist.

|     |       |                           |
|-----|-------|---------------------------|
| 500 | parts | Tragacanth (60:1000)      |
| 150 | „     | Sodium Acetate cryst.     |
| 100 | „     | Bisulphite of Soda 66° Tw |
| 250 | „     | Water                     |

1000 parts.

Coloured Pigment Discharges.

|     |       |                       |
|-----|-------|-----------------------|
| 500 | parts | Pigment               |
| 220 | „     | Tragacanth (60:1000)  |
| 150 | „     | Albumen 1:1           |
| 130 | „     | Sodium Acetate cryst. |

1000 parts.

Coloured Discharge I.

|     |       |                         |
|-----|-------|-------------------------|
| 20  | parts | Colouring Matter        |
| 100 | „     | Water                   |
| 200 | „     | Acetic Acid 12° Tw      |
| 450 | „     | Acid Starch (page 126)  |
| 30  | „     | Glycerine               |
| 200 | „     | Oxide of Zinc paste 1:1 |

1000 parts.

Suitable for all basic dyes.

Oxide of Zinc paste 1:1.

|     |       |               |
|-----|-------|---------------|
| 500 | parts | Oxide of Zinc |
| 500 | „     | Water         |

1000 parts.

Coloured Discharge II.

|     |       |                        |
|-----|-------|------------------------|
| 20  | parts | Colouring Matter       |
| 200 | „     | Water                  |
| 400 | „     | Tragacanth (60:1000)   |
| 200 | „     | Acetate of Zinc cryst. |
| 200 | „     | Albumen 1:1.           |

Resists under Aniline Black.

White Resist.

|     |       |                                 |
|-----|-------|---------------------------------|
| 70  | parts | Oxide of Zinc                   |
| 309 | „     | Water                           |
| 75  | „     | British Gum powder              |
| 165 | „     | Tragacanth (60:1000)            |
| 56  | „     | Soda Lye 36° Tw                 |
| 30  | „     | Sulphocyanide of Ammonia 32° Tw |
| 295 | „     | Sodium Acetate cryst.           |

1000 parts.

## Coloured Resist.

|             |                        |
|-------------|------------------------|
| 20 parts    | Colouring Matter       |
| 180 "       | Water                  |
| 760 "       | Zinc paste             |
| 40 "        | Acetate of Soda cryst. |
| <hr/>       |                        |
| 1000 parts. |                        |

Suitable for all basic dyes.

## Zinc paste.

|             |               |
|-------------|---------------|
| 105 parts   | Wheat Starch  |
| 25 "        | British Gum   |
| 715 "       | Water         |
| 155 "       | Oxide of Zinc |
| <hr/>       |               |
| 1000 parts. |               |

## 6. Resist effects upon colours, which are produced upon the fibre by a process of condensation.

## Nitroso Blue Resist Styles.

For the production of Nitroso Blue Resist styles the goods are padded as described on page 144, dried in the hotflue; printed with the Resists (as below); steamed for 2—3 min. in the Mather-Platt at 210—212° F; passed through an Antimony bath; washed and soaped.

The Resists contain either Sulphites or Tin Salts, for coloured effects basic colours are used.

## White Resists.

## Sulphite White Resist.

|             |                              |
|-------------|------------------------------|
| 300 parts   | British Gum powder           |
| 700 "       | Sulphite of Potassium 91° Tw |
| <hr/>       |                              |
| 1000 parts. | Heat on the water bath.      |

## Alkaline Sulphite White Resist.

|             |                              |
|-------------|------------------------------|
| 240 parts   | British Gum powder           |
| 560 "       | Sulphite of Potassium 91° Tw |
| 120 "       | Soda Lye 91° Tw              |
| 80 "        | Water                        |
| <hr/>       |                              |
| 1000 parts. |                              |

## White Underprint.

|             |                        |
|-------------|------------------------|
| 220 parts   | British Gum powder     |
| 400 "       | Water                  |
| 60 "        | Sodium Tartar Emetic   |
| 170 "       | Glue sol. 1:2          |
| 110 "       | Tin Cryst. Ia.         |
|             | after cooling add      |
| 40 "        | Acetate of Soda cryst. |
| <hr/>       |                        |
| 1000 parts. |                        |

This Resist, is printed upon white material and withstands the passage through the padding liquid and subsequent drying over cylinders.



## Coloured Resists.

## Sulphite Resists.

|                          | — pts.    | — pts.    | — pts.    | 32 pts.   | — parts.  |
|--------------------------|-----------|-----------|-----------|-----------|-----------|
| Rosazeine 4 G pat.       | —         | —         | —         | —         | —         |
| Auramine O pat.          | 30        | 24        | 15        | 5,6       | —         |
| Malachite Green cr. ext. | —         | —         | 15        | —         | —         |
| Safranine O              | —         | —         | —         | 16        | —         |
| Acridine Orange NO       | —         | 6         | —         | —         | —         |
| Methylene Blue DR        | —         | —         | —         | —         | 30        |
| Water                    | 320       | 320       | 320       | 297       | 320       |
| Glycerine                | 30        | 30        | 30        | 30        | 30        |
| Antimony Thickening I    | 500       | 500       | 500       | 500       | 500       |
| Sulphite of Potassium    |           |           |           |           |           |
| 91° Tw                   | 120       | 120       | 120       | 120       | 120       |
|                          | 1000 pts. | 1000 pts. | 1000 pts. | 1000 pts. | 1000 pts. |

## Tin Salt Resist.

|                          | 20 pts.   | — pts.    | — pts.    | 20 pts.   | — pts.    |
|--------------------------|-----------|-----------|-----------|-----------|-----------|
| Auramine O pat.          | 20        | —         | —         | —         | —         |
| Acridine Orange NO       | 10        | 2         | —         | —         | —         |
| Safranine AN extra       | —         | 8         | 18        | —         | —         |
| Rosazeine 6 G            | —         | —         | 6         | —         | —         |
| Thioflavine T            | —         | —         | 6         | —         | —         |
| Malachite Green cr. ext. | —         | —         | —         | 10        | —         |
| Methylene Blue DR        | —         | —         | —         | —         | 30        |
| Water                    | 220       | 240       | 220       | 220       | 220       |
| Antimony Thickening II   | 500       | 500       | 500       | 500       | 500       |
| Standard Discharge       |           |           |           |           |           |
| White                    | 250       | 250       | 250       | 250       | 250       |
|                          | 1000 pts. | 1000 pts. | 1000 pts. | 1000 pts. | 1000 pts. |

## Antimony Thickening I.

|             |                        |
|-------------|------------------------|
| 40 parts    | Wheat Starch           |
| 300         | British Gum            |
| 335         | Water                  |
| 250         | Tragacanth (60:1000)   |
| 75          | Antimonin (Boehringer) |
| 1000 parts. |                        |

## Antimony Thickening II.

|             |                        |
|-------------|------------------------|
| 840 parts   | Acid Starch (page 126) |
| 80          | Antimonin (Boehringer) |
| 80          | Acetic Acid 12° Tw     |
| 1000 parts. |                        |

## Discharge White Standard.

|             |                          |
|-------------|--------------------------|
| 250 parts   | Acid Starch (page 126)   |
| 500         | Tin Salt Ia. cryst.      |
| 200         | Sulphocyanide of Ammonia |
| 50          | Acetic Acid 12° Tw       |
| 1000 parts. |                          |



and soaped, or soured in order to improve the white, in the usual manner. In rare cases the Resists are printed on white material, the latter then naphtholated in the printing machine and finally dyed with Diazo solution.

In order to obtain even results as regards shade (depth and beauty) and as regards the printed effect (purity of the white or coloured resists), also in order to prevent the printed colours from staining the blotch, the dyeing apparatus ought to be carefully designed.

The apparatus consists of:

1. Squeezing rollers with a small furnishing box containing 1 or 2 guiding rollers. The lower squeezing roller is wrapped and ought to dip slightly into the developing liquid. In this case the pieces are passed with the face upwards through the squeezing rollers, the top one of which is not wrapped and in some cases contains a brush arranged length-wise.

2. An arrangement for letting the pieces pass over a system of guiding rollers in the air, so as to allow the Azo Colours to form themselves.

3. A system of roller cisterns containing perforated spray-pipes, Acid bath and water tanks.

Another arrangement of the padding machine which answers well for covered designs (Tannin Resist-Blue Red styles) is to be seen from the sketch on page 172.

The developing liquid is supplied by a loose endless felt-band, which runs over 2 guiding rollers in the dye-liquid and passes creaseless through the 2 wrapped squeezing rollers.

The most important Resists for Azo Colour styles are: Tin, Sulphite and Tannin-Resists.

### 1. Tin Resists.

Protoxide salts of Tin, especially the commercial Tin crystals, exercise a most energetic resisting action upon Diazo-compounds, which are easily split by them.

Since several organic Acids (Tartaric, Citric, Oxalic Acid) also act as resisting ingredients and at the same time cleanse the white obtained with Tin salt Resists, they are mostly added to the latter. It is important to use only the best Tin Crystals which have no yellowish appearance and are easily soluble. In order to increase the resisting action of Tin salt colours, some mechanically resisting ingredients such as China Clay, Glue, Paraffin, Wax are added to them.

Tin salt or Acetate of Tin Resists can be mixed with the following colours for the production of coloured effects:

1. Basic Colours with or without tannin e. g. Auramine, Brilliant Green, Malachite Green, Methyl Violet, Methylene Blue, Marine Blue, Ethyl Blue, Victoria Blue, Phosphine, Rosazaine 4G pat.

2. Dyestuffs which form a vat, when reduced, such as Discharge Blue BZ.

3. Pigment Colours such as Chrome Yellow, Chrome Orange, Guignet Green.

## White Resists.

## White Resist I.

|       |        |                        |
|-------|--------|------------------------|
| 580   | parts  | Acid Starch (page 126) |
| 335   | „      | Tin crystals Ia        |
| 33    | „      | Citric Acid            |
| 52    | „      | Water                  |
| <hr/> |        |                        |
| 1000  | parts. |                        |

## White Resist II.

|       |        |                        |
|-------|--------|------------------------|
| 250   | parts  | Acid Starch (page 126) |
| 250   | „      | Tin crystals Ia        |
| 50    | „      | Tartaric Acid          |
| 350   | „      | Glue Solution 1:2      |
| 100   | „      | China Clay             |
| <hr/> |        |                        |
| 1000  | parts. |                        |

## White Resist III.

|       |        |               |
|-------|--------|---------------|
| 700   | parts  | Thickening A  |
| 200   | „      | Tin cryst. Ia |
| 100   | „      | Water         |
| <hr/> |        |               |
| 1000  | parts. |               |

## Thickening A.

|       |        |                                   |
|-------|--------|-----------------------------------|
| 300   | parts  | British Gum powder                |
| 300   | „      | Water                             |
| 300   | „      | Glue solution 1:2, are boiled and |
| 100   | „      | White Bees' Wax added             |
| <hr/> |        |                                   |
| 1000  | parts. |                                   |

## Glue Solution 1:2

|                                        |        |                                          |
|----------------------------------------|--------|------------------------------------------|
| 333                                    | parts  | Glue are soaked in                       |
| 500                                    | „      | Water and after addition of              |
| 167                                    | „      | Acetic Acid 12° Tw dissolved by boiling. |
| The quantity evaporated by the boiling |        |                                          |
| is replaced by dilute acetic acid.     |        |                                          |
| <hr/>                                  |        |                                          |
| 1000                                   | parts. |                                          |

## Coloured Resists.

## a) With basic dyes.

|                              | Yellow   | Green    | Blue     |
|------------------------------|----------|----------|----------|
| Auramine conc. pat.          | 30 parts | 10 parts | —        |
| Brilliant Green cryst. extra | — „      | 10 „     | —        |
| Marine Blue BI               | — „      | — „      | 20 parts |
| Acetic Acid 6° Tw            | 210 „    | 190 „    | 190 „    |
| Acid Starch (page 126)       | 450 „    | 500 „    | 500 „    |
| Tartaric Acid                | 50 „     | 50 „     | 50 „     |
| Glycerine                    | 50 „     | 50 „     | 50 „     |
| Acetic Acid Tannin sol. 1:1  | 90 „     | 60 „     | 60 „     |
| Tin crystals Ia              | 150 „    | — „      | —        |
| Acetate of Tin 32° Tw        | — „      | 150 „    | 150 „    |
| <hr/>                        |          |          |          |

b) With pigment colours.

Chrome Yellow Resist.

|      |        |                         |
|------|--------|-------------------------|
| 300  | parts  | Chrome Yellow 50% paste |
| 100  | „      | Glycerine               |
| 60   | „      | Water                   |
| 200  | „      | Tragacanth (60:1000)    |
| 40   | „      | Tartaric Acid           |
| 300  | „      | Tin crystals Ia         |
| 1000 | parts. |                         |

## 2. Sulphite Resists.

Sulphite Resists are prepared with concentrated solutions of Potassium Sulphite or of Sodium Bisulphite neutralized with Ammonia; they are thickened with British Gum, Dextrine or Gum. The Potassium Sulphite is generally preferred to the other Sulphites on account of its easy solubility.

The Sulphite Resists produce a purer, less yellowish White under Paranitraniline and Azophor Red than Tin Resists, moreover there is no danger of corroding the fibre. On the other hand a better White is produced under  $\alpha$ -Naphthylamine Claret Red with Tin salt than with Sulphite Resists.

The most important Sulphite Resists are:

White Resist IV.

|      |        |                              |                |
|------|--------|------------------------------|----------------|
| 250  | parts  | British Gum powder           | } dissolve hot |
| 750  | „      | Sulphite of Potassium 91° Tw |                |
| 1000 | parts. |                              |                |

White Resist V.

|      |        |                                            |
|------|--------|--------------------------------------------|
| 280  | parts  | Thickening A (page 174)                    |
| 80   | „      | Britishgum                                 |
| 560  | „      | Sulphite of Potassium 91° Tw, heat and add |
| 80   | „      | Oxide of Tin, powder                       |
| 1000 | parts. |                                            |

For the production of Coloured Resists, pigment colours are used, e. g.:

Blue Resist U.

|      |        |                                           |
|------|--------|-------------------------------------------|
| 300  | parts  | Ultramarine powder are finely ground with |
| 20   | „      | Glycerine and                             |
| 180  | „      | Water. Then                               |
| 100  | „      | Tragacanth (60:1000)                      |
| 150  | „      | Albumen (1:1) and                         |
| 250  | „      | Sulphite of Potassium 91° Tw are added    |
| 1000 | parts. |                                           |

## 3. Tannin Resists.

Tannin is a very energetic Resist and is therefore used for producing coloured Resists on Naphthol grounding, fast to washing. The firm of Rolffs & Co. in Siegburg hold a patent D.R.P. No. 113238

for this application. — The coloured Tin Resists (described previously) produce effects, which are decidedly inferior as regards depth of shade and fastness to washing on account of the lake formation which takes place within the printing paste; therefore the Tannin Resist with its energetic resisting action, altho' no Tin salt is used, presents a considerable improvement upon the old Resist process.

A dark, fast Blue Resist is produced upon Naphthol-bottom with the following Tannin Resist Colour:

#### Tannin Resist Blue.

|             |                                   |
|-------------|-----------------------------------|
| 30 parts    | Ethyl Blue BD pat.                |
| 5 „         | Marine Blue BI                    |
| 5 „         | Violet Crystals O                 |
| 100 „       | Acetic Acid 6° Tw                 |
| 150 „       | Water                             |
| 40 „        | Tartaric Acid                     |
| 550 „       | Acid Starch (page 126)            |
| 120 „       | Acetic Acid Tannin Solution (1:1) |
| 1000 parts. |                                   |

In order to fix these Tannin Resists it is advisable to dry the pieces well before, and to hang them after printing, in a warm room, or to steam them in the Mather-Platt before developing in the Diazo-bath.

Since the depth of the Azo-colours is unfavourably influenced by steaming the naphtholated and printed material before developing, (especially if the material touches the hot copper rollers in the Mather-Platt apparatus), it is advisable to cover or partly cover these copper rollers with wooden strips, (lengthways); which reduces the drawback to a minimum.

After steaming, the goods are developed in the Diazo-bath; the apparatus sketched on page 172 is most suitable for this purpose. Instead of printing the tannin colours on Naphthol bottom, the following process may be applied: the acid tannin colours are printed on white material, and steamed from  $\frac{1}{2}$ —1 hour; then the goods are padded with naphthol solution (without having been washed), and developed in the Diazo-bath.

The naphthol solution is mostly padded in the printing machine, and it is advisable to pass the goods, especially thin material, face downwards through the machine.

#### b) Discharge-Styles.

Certain insoluble Azo colours can be discharged with white and coloured discharges; two methods are applicable:

1. Discharging with Protoxide of Tin colours.
2. Discharging with Glucose and Alkali.

The discharge colours generally produce more brilliant, and faster effects than Tin-salt resists; especially by means of the alkali-discharge, the Turkey-red discharge styles can be imitated.

### 1. Tin-Discharge.

Insoluble Azo Colours produced on the fibre withstand the action of concentrated Protoxide of Tin discharges, but Henry Schmid succeeded in 1896, in producing pure white and coloured discharge effects, by adding to the Tin discharge certain ingredients, which exercise an energetic soling influence upon these colours.

The following preparations are used for this purpose.

Discharge White PN pat.

Discharge Blue PN pat.

Discharge Blue PPN pat.

Discharge Yellow PN pat.

Discharge Green PN pat.

These discharges are suitable for Azo Colours made from: p-Nitraniline, m-Nitraniline, Nitro-Toluidine, Nitro-Phenetidine,  $\beta$ -Naphthylamine and Amido-Azo-Benzene, but they do not discharge those produced with  $\alpha$ -Naphthylamine, Benzidine, Tolidine and Dianisidine.

The printing-colours are prepared in the following manner:

Discharge White.

50 parts Wheat Starch (powder)

30 „ British Gum

1000 „ Discharge White PN pat.

After stirring well, the whole is heated on the water-bath and sieved.

Discharge-Blue, Yellow and Green, are mixed in the same manner.

The colours which are reduced according to requirements, are printed upon the dyed material (a brush furnishing-case is best used), well dried, (in order to avoid bleeding), and steamed in the Mather-Platt for 5—7 min. with powerful hot steam, which must be free from air.

Discharge White ought to produce a pure white effect directly after steaming. — Oxydation aniline black, which might have been printed along with the discharge, is developed before steaming, by hanging the pieces in the oxydation-room. After steaming, the goods are passed through acid-baths (muriatic acid  $\frac{3}{4}$  to  $1\frac{1}{2}$ ° Tw) in order to remove Tin compounds and reduction-products, or eventually through a weak acid chloride of lime solution, which produces a very pure white, and increases the brilliancy of the Para-red, which may have suffered somewhat in steaming. — For goods which contain, besides the white Discharge, Aniline Black, or Discharge-Blue, the following treatment in a system of roller cisterns is suitable:

1. Cistern: 35 parts muriatic acid 32° Tw per 1000 parts of liquid at 140° F for  $\frac{1}{2}$  minute, squeezing.
2. Cistern: Cold water; system of spray-pipes; squeezing.
3. Cistern: Warm acidified Chrome-bath (3 parts bichromate of soda and 35 parts of muriatic acid 32° Tw per 1000) at 140° F for  $\frac{1}{2}$  minute; squeezing.
4. Cistern: 35 parts muriatic acid 32° Tw per 1000 parts at 140° F,  $\frac{1}{2}$ —1 minute, then well washing and drying.

If the acid treatment is not made sufficiently effective, small amounts of chrome-oxide are fixed upon the discharged places, and these tint the white greenish. The last acid bath may also be applied to the pieces in rope-form.

For multi-coloured styles, containing yellow and green, neither the chloride of lime-bath, nor the treatment with chrome has been found suitable; for these styles, a tartar-emetic bath, such as is employed for tannin-colours, with subsequent thorough washing, has shewn the best results (washing in running water is preferable, in order to quickly re-oxidize the reduced blue and green colours). Likewise Peroxide of Hydrogen by itself, or together with some soap-solution, or small quantities of acid has been found suitable for the after-treatment of multi-coloured discharge-prints.

During the washing and drying operation, the reduced and colourless discharge blue and green colours are oxidized to the blue and green tin lake.

## 2. Alkali-glucose Discharge.

According to a patent, which has been granted Messrs. Schlaepfer, Wenner & Co. in Salerno (D.R.P. No. 98796): "a method for discharging Paranitraniline-red with grape-sugar, and strong caustic lye, in the presence of Glycerine, Phenol &c", Paranitraniline-red is padded with a strong solution of grape-sugar 25° Tw, dried over cylinders, and printed with discharge-colours. After drying, the pieces are steamed for one minute, in the Mather-Platt quick-steaming apparatus, with very hot, powerful steam, which ought to be free from air; then passed at full width through sulphuric acid 9° Tw, washed, soaped, and chromed, if required, so as to develop the blue and green.

### Discharge White.

|          |                     |
|----------|---------------------|
| 70 parts | light burnt Starch  |
| 170 "    | Glycerine           |
| 100 "    | Gum solution 1:1    |
| 530 "    | Soda lye 106° Tw    |
| 130 "    | Glucose sol. 53° Tw |
| 1000     | parts.              |

### Discharge Yellow.

|           |                 |
|-----------|-----------------|
| 525 parts | Lead paste      |
| 475 "     | Discharge White |
| 1000      | parts.          |

### Lead paste.

|           |                  |
|-----------|------------------|
| 265 parts | Litharge         |
| 165 "     | Glycerine        |
| 570 "     | Soda Lye 106° Tw |
| 1000      | parts.           |

### Discharge Blue.

|           |                       |
|-----------|-----------------------|
| 270 parts | Alkaline Indigo paste |
| 730 "     | Standard Discharge    |
| 1000      | parts.                |

### Alkaline Indigo paste.

|           |                                         |
|-----------|-----------------------------------------|
| 350 parts | Indigo MLB powder<br>finely ground with |
| 650 "     | Soda Lye 66° Tw                         |
| 1000      | parts.                                  |

### Standard Discharge.

|          |                    |
|----------|--------------------|
| 55 parts | light burnt Starch |
| 140 "    | Water              |
| 180 "    | Glycerine          |
| 95 "     | Gum sol. (1:1)     |
| 530 "    | Soda Lye 106° Tw   |
| 1000     | parts.             |

Green is produced by mixing Discharge Blue and Discharge Yellow without glucose.

## 8. Discharge effects upon sulphur-colours.

Shades which have been produced with sulphur-colours, especially with Melanogen Blue B pat. (page 148) can be discharged by means of the chlorate discharge. Alumina-chlorate discharges (page 152) are especially suitable for this purpose.

Indigo blues on Melanogen-Blue bottom can also be discharged with chlorate discharge, or by means of the chromate discharge, given on page 164.



# 9. Table shewing the dischargeable qualities of cotton colours.

1. Colours discharged to a pure white, even in dark shades.
2. Colours discharged white in light shades.
3. Colours, not discharged white, but suitable for bright coloured discharges.
4. Colours not discharged white, suitable only for dark coloured discharges.
5. Colours not discharged at all, and therefore suitable for additions to coloured discharge-pastes.

| Dyestuff             | Tin Dis-charge | Zinc Dis-charge | Chlorate Dis-charge | Sulphite of Potassium Dis-charge | Observations                                 |
|----------------------|----------------|-----------------|---------------------|----------------------------------|----------------------------------------------|
| Auramine             | 5              | 4—5             | 1                   | 4—5                              |                                              |
| Phosphine            | 5              | 4—5             | 1—2                 | 4—5                              |                                              |
| Azophosphine         | 2—3            | 2               | 1                   | 3—4                              |                                              |
| Chrysoidine          | 2—3            | 2               | 1—2*                | 3—4                              | * Shade is changed by a treatment with Soda. |
| Vesuvine             | 2—3            | 2               | 2*                  | 4                                | * do.                                        |
| Cutch Brown          | 3              | 2               | 2—3*                | 4                                | * do.                                        |
| Dark Brown           | 4              | 2—3             | 2—3*                | 4                                | * do.                                        |
| Magenta              | 5              | 2—3             | 1                   | 1—2                              |                                              |
| Cerise               | 5              | 2—3             | 2                   | 3—4                              |                                              |
| Grenadine            | 5              | 2               | 2                   | 3—4                              |                                              |
| Maroon               | 5              | 2               | 2                   | 3—4                              |                                              |
| New Magenta          | 5              | 2—3             | 1                   | 1—2                              |                                              |
| Safranine            | 5              | 5               | 1—2                 | 5                                |                                              |
| Methylene Violet     | 5              | 4—5             | 1—2                 | 4—5                              |                                              |
| Methylene Heliotrope | 5              | 4—5             | 2—3                 | 4—5                              |                                              |
| Methyl Violet        | 5              | 2—3             | 1                   | 5                                |                                              |

| Dyestuff             | Tin Dis-charge | Zinc Dis-charge | Chlorate Dis-charge | Sulphite of Potassium Dis-charge | Observations                                 |
|----------------------|----------------|-----------------|---------------------|----------------------------------|----------------------------------------------|
| Violet crystals      | 5              | 2—3             | 1                   | 5                                |                                              |
| Victoria Blue        | 5              | 2—3             | 1                   | 5                                |                                              |
| Malachite Green      | 5              | 2—3             | 1                   | 2—3                              |                                              |
| Brilliant Green      | 5              | 2—3             | 1                   | 2—3                              |                                              |
| Rosazeine            | 5              | 5               | 1—2                 | 4                                | Alkaline Potassium Sulphite Discharge 1—2.   |
| Rosazeine 4G         | 5              | 5               | 1—2                 | 3—4                              |                                              |
| Methylene Blue       | 5              | 3—4             | 2—3                 | 2—3                              |                                              |
| Marine Blue          | 5              | 2—3             | 1—2                 | 4                                |                                              |
| Methylene Green      | 5              | 3—4             | 2                   | 2—3                              |                                              |
| Ethyl Blue           | 5              | 4—5             | 1—2                 | 5                                |                                              |
| Indophene Blue       | 4*             | 4*              | 1—2                 | 4*                               | * Discharged red.                            |
| New Fast Blue        | 4—5            | 2—3             | 2—3*                | 3—4                              | * Shade is changed by a treatment with Soda. |
| Fast Blue for Cotton | 4—5            | 2—3             | 2—3*                | 3—4                              | * do.                                        |
| Methylene Grey       | 5              | 4—5             | 1—2                 | 3—4                              |                                              |
| Janus Yellow         | 4—5            | 4—5             | 1—2                 | 5                                |                                              |
| Janus Red            | 2              | 2               | 1—2                 | 4                                |                                              |
| Janus Brown          | 4              | 3               | 2—3                 | 4—5                              |                                              |
| Janus Blue           | 4*             | 4*              | 1—2                 | 4*                               | * Discharged violet to red.                  |
| Janus Dark-blue      | 4*             | 4*              | 2—3                 | 4*                               | * Discharged red.                            |
| Janus Green          | 4*             | 4*              | 3                   | 4*                               | * Discharged violet.                         |
| Janus Black          | 4*             | 4*              | 4                   | 4—5*                             | * do.                                        |

| Dyestuff                         | Tin Dis-charge | Zinc Dis-charge | Chlorate Dis-charge | Sulphite of Potas-sium Dis-charge | Observations                                                                                                                                                    |
|----------------------------------|----------------|-----------------|---------------------|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Janus Grey                       | 4*             | 4*              | 1—2                 | 4*                                | * Discharged violet.                                                                                                                                            |
| Cotton Light-blue                | 4—5            | 1               | 1                   | 1                                 |                                                                                                                                                                 |
| Methyl Blue for Cotton           | 4—5            | 1               | 1                   | 1                                 |                                                                                                                                                                 |
| Alizarine Yellow GG              | 4              | 4               | 4—5                 | 4                                 |                                                                                                                                                                 |
| Alizarine Yellow R               | 4              | 4               | 4                   | 3—4                               |                                                                                                                                                                 |
| Alizarine Orange Alumina Mordant | 4—5*           | 4*              | 2—3                 | 5                                 | * Discharged grey.                                                                                                                                              |
| Alizarine Orange Chrome Mordant  | 4—5*           | 4—5*            | 2—3                 | 5                                 | * do.                                                                                                                                                           |
| Alizarine Red Alumina Mordant    | 4—5            | 4—5             | 2                   | 5                                 | Can be dis-<br>charged to a<br>pure white, (1)<br>as Turkey Red<br>with the Chlo-<br>ride of Lime<br>Vat as well as<br>with the Glu-<br>cose-alkali<br>process. |
| Alizarine Red Chrome Mordant     | 4—5*           | 5*              | 1—2                 | 5                                 | * Discharged grey.                                                                                                                                              |
| Alizarine Brown                  | 4—5*           | 4               | 2—3                 | 5                                 | * do.                                                                                                                                                           |
| Alizarine Claret Alumina Mordant | 4—5*           | 4               | 1—2                 | 5                                 | * do.                                                                                                                                                           |

Dyed upon mordanted material.

| Dyestuff                                 | Tin Dis-charge | Zinc Dis-charge | Chlorate Dis-charge | Sulphite of Potassium Dis-charge | Observations                                                                           |
|------------------------------------------|----------------|-----------------|---------------------|----------------------------------|----------------------------------------------------------------------------------------|
| Alizarine<br>Claret<br>Chrome<br>Mordant | 4-5*           | 4-5             | 2-3                 | 5                                | * Discharged grey                                                                      |
| Alizarine Blue                           | 4-5            | 4-5             | 2                   | 4-5                              | Dyed upon mordanted material.                                                          |
| Alizarine Green                          | 4-5            | 5               | 2-3                 | 4-5*                             | * Discharged violet                                                                    |
| Ceruleine                                | 5              | 5               | 2-3                 | 4-5                              |                                                                                        |
| Cresotine Yellow                         | 1-2            | 2               | 1                   | 4-5                              | To obtain pure discharges it is advisable to develop with Solidogen after discharging. |
| Aurophenine                              | 1              | 2               | 2-3                 | 4-5                              |                                                                                        |
| Oxydianil Yellow                         | 5              | 5               | 5                   | 5                                |                                                                                        |
| Dianil Yellow                            | 4-5            | 4-5             | 4-5                 | 4-5                              | Solidogen development after discharging produces purer effects.                        |
| Dianil Orange                            | 4-5            | 4-5             | 2-3                 | 3-4                              |                                                                                        |
| Dianil Orange N                          | 1-2            | 3               | 2                   | 4-5                              |                                                                                        |
| Toluylene Orange R                       | 2              | 3               | 1-2                 | 5                                |                                                                                        |
| Dianil Red R                             | 1              | 2               | 2-3                 | 3-4                              |                                                                                        |
| Dianil Red 4B                            | 1              | 1               | 2-3                 | 4-5                              |                                                                                        |
| Dianil Red 10B                           | 1              | 2               | 2-3                 | 4                                |                                                                                        |
| BrilliantDianil Red R                    | 1-2            | 3               | 2                   | 4-5                              |                                                                                        |
| Delta Purpurine 5B                       | 1-2            | 3               | 2                   | 4-5                              |                                                                                        |
| Dianil Claret Red                        | 1-2            | 1-2             | 2-3                 | 4*                               | * Discharged a yellowish red                                                           |
| Dianil Blue                              | 1-2            | 1-2             | 2                   | 2-3                              |                                                                                        |

| Dyestuff               | Tin Dis-charge | Zinc Dis-charge | Chlorate Dis-charge | Sulphite of Potassium Dis-charge | Observations                                                       |
|------------------------|----------------|-----------------|---------------------|----------------------------------|--------------------------------------------------------------------|
| Dianil Dark-blue       | 2              | 1-2             | 2-3                 | 3-4                              | Solidogen development after discharging produces purer effects.    |
| Dianil Brown           | 2              | 2               | 2-3                 | 4-5                              |                                                                    |
| Dianil Fast Brown B    | 2-3            | 2-3             | 2-3                 | 4                                |                                                                    |
| Dianil Black           | 2-3            | 2               | 2-3                 | 3                                |                                                                    |
| Dianil Black N, CR, PG | 3-4            | 4               | 3-4                 | 4                                | * Shade is changed by steaming and by treating with soda.<br>* do. |
| Melanogen Blue         | 3              | 3-4             | 1*                  | 3-4                              |                                                                    |
| Melanogen              | 3-4            | 4               | 2*                  | 4-5                              |                                                                    |
| Thiogen Brown          | 4              | 4               | 3-4                 | 5                                | Chrome Discharge 1, Prussiate Discharge 1.                         |
| Indigo                 | 4              | 4               | 1                   | 5                                |                                                                    |

## V. COTTON YARN PRINTING.

### 1. Bleaching the yarn.

Almost all yarns, which are to be printed, must be bleached, unless the print effect is produced upon dyed material. The yarns, packed in bags, are boiled in clean water for 3—4 h in a closed vessel under pressure of  $1\frac{1}{2}$ —2 atm., then the steam is turned off and the yellowish boiling-off liquor let off, while fresh water is sprayed over the yarns in a continuous stream. In this manner the boiling-off liquor is quickly removed from the yarn and the formation of boil-spots avoided. After watering the yarns are immersed for 6—7 h into a clear Chloride of Lime bath of  $1$ — $1\frac{1}{2}$ ° Tw, then soured with Sulphuric Acid and well washed in the washing machine. Finally the yarns are carefully dried.

### 2. Preparing the printing Colours.

a) Basic Colours. In preparing the printing pastes, a starch-emulsion and then the solution of the dyestuffs in Acetic Acid and  $\frac{1}{2}$  litre Water are added to the Tragacanth thickening 60:1000. After boiling this mixture well, and then somewhat cooling it, the Tannin Acetic Acid solution 1:1 is added and the whole made up to 1 Kilo. If the paste is cooled down too far, when the Tannin solution is added, the Tannin lake of the dyestuffs will be precipitated within the paste, which makes the colour unsuitable for printing. The printing colour is sieved before use.

b) Alizarine Colours. Starch, Acetic Acid and Tragacanth are well boiled; and stirred till perfectly cool; then the colour, pasted with water, is added; then the mordant stirred into the paste and the whole made up to 1 litre; finally the colour is strained through a sieve or cloth.

c) Aniline Black. Starch, Aniline Salt and Water are boiled; when lukewarm, Chlorate of Potassium and Chloride of Ammonia are added; the mixture stirred till perfectly cold and Copper Sulphite (pasted with Water) added. The whole is made up to 1 litre and sieved.

The yarns are printed on an Iron-machine or on the mangle. The former machine is employed for small, fine designs, while the mangle is used for heavy prints. The printing colours are made in a similar manner for both machines, but for mangle-printing the colours are kept thinner, and the addition of starch can be dispensed with.

Multi-coloured effects on yarn are produced on the two or more coloured-printing machine. The printing pastes have the same consistency as those for mangle-printing.

Since the yarn printing machines carry more colour on to the material than the calico printing machines, and the prints consist mostly of light effects, all printing colours must be kept rather weaker than those used in Calico printing.

### 3. Printing recipes.

#### a) For the iron machine.

The following recipes have produced good results in practice:

##### Red.

|             |                           |
|-------------|---------------------------|
| 570 parts   | Water                     |
| 50 "        | Wheat Starch              |
| 175 "       | Tragacanth (60:1000)      |
| 75 "        | Acetic Acid 30%           |
| 10 "        | Alizarine RX 40%          |
| 20 "        | Alizarine 2RG 40%         |
| 50 "        | Acetate of Lime 15° Tw    |
| 50 "        | Acetate of Alumina 18° Tw |
| <hr/>       |                           |
| 1000 parts. |                           |

Printed upon oil prepared yarn (2—3 lbs neutralised Turkey Red Soda Oil per 100 lbs of yarn), dried, steamed  $\frac{3}{4}$  h, soaped at 158—176° F with 2 parts neutral soap in 1000 parts water, and washed.

##### Blue.

|             |                                         |
|-------------|-----------------------------------------|
| 728 parts   | Water                                   |
| 46 "        | Wheat Starch                            |
| 175 "       | Tragacanth (60:1000)                    |
| 25 "        | Alizarine Blue SB powder                |
| 26 "        | Acetate of Chrome 32 $\frac{1}{2}$ ° Tw |
| <hr/>       |                                         |
| 1000 parts. |                                         |

Printed upon unprepared yarn, dried, and steamed for 1 h.

##### Brown.

|             |                                         |
|-------------|-----------------------------------------|
| 625 parts   | Water                                   |
| 43 "        | Wheat Starch                            |
| 160 "       | Tragacanth (60:1000)                    |
| 25 "        | Acetic Acid 30%                         |
| 60 "        | Alizarine Orange N paste                |
| 8 "         | Alizarine Blue SB powder                |
| 4 "         | Alizarine Yellow R paste                |
| 75 "        | Acetate of Chrome 32 $\frac{1}{2}$ ° Tw |
| <hr/>       |                                         |
| 1000 parts. |                                         |

Printed upon unprepared yarn, dried, and steamed for 1 h.

## Aniline Black.

|          |                            |
|----------|----------------------------|
| 70 parts | Wheat Starch               |
| 882      | „ Water                    |
| 30       | „ Aniline Black            |
| 15       | „ Chlorate of Soda         |
| 3        | „ Vanadium sol. (page 127) |
| <hr/>    |                            |
| 1000     | parts.                     |

Printed, dried, aired for 12 h in a hot chamber at 86 to 95° F and developed for  $\frac{1}{2}$  h with 2 to 3 parts white lime (chalk) per 1000 parts lukewarm water (68° F), well washed and dried. If the black is printed on a dyed bottom, soda is to be preferred to lime in developing.

## Pink.

|           |                               |
|-----------|-------------------------------|
| 686 parts | Water                         |
| 43        | „ Wheat Starch                |
| 160       | „ Tragacanth (60:1000)        |
| 100       | „ Acetic Acid 30%             |
| 1         | „ Safranine conc.             |
| 5         | „ Tartaric Acid               |
| 5         | „ Acetic Acid Tannin sol. 1:1 |
| <hr/>     |                               |
| 1000      | parts.                        |

Printed, dried, steamed for  $\frac{1}{2}$  h, then immersed in a luke warm tartar emetic bath (2 parts per 1000 parts water), and finally washed.

## Claret.

|           |                                   |
|-----------|-----------------------------------|
| 642 parts | Water                             |
| 43        | „ Wheat Starch                    |
| 160       | „ Tragacanth (60:1000)            |
| 100       | „ Acetic Acid 30%                 |
| 5         | „ Methylene Violet 3RA extra      |
| 5         | „ Safranine conc.                 |
| 5         | „ Tartaric Acid                   |
| 40        | „ Acetic Acid Tannin solution 1:1 |
| <hr/>     |                                   |
| 1000      | parts.                            |

Directions as for Pink.

## Grey.

|           |                                   |
|-----------|-----------------------------------|
| 661 parts | Water                             |
| 43        | „ Wheat Starch                    |
| 160       | „ Tragacanth (60:1000)            |
| 100       | „ Acetic Acid 30%                 |
| 2         | „ Ethyl Blue BF pat.              |
| 4         | „ Methylene Grey NF powder        |
| 5         | „ Tartaric Acid                   |
| 25        | „ Acetic Acid Tannin solution 1:1 |
| <hr/>     |                                   |
| 1000      | parts.                            |

Directions as for Pink.



## Violet.

|       |        |                                 |
|-------|--------|---------------------------------|
| 675   | parts  | Water                           |
| 35    | „      | Wheat Starch                    |
| 160   | „      | Tragacanth (60:1000)            |
| 100   | „      | Acetic Acid 30%                 |
| 5     | „      | Methyl Violet BB                |
| 5     | „      | Tartaric Acid                   |
| 20    | „      | Acetic Acid Tannin solution 1:1 |
| <hr/> |        |                                 |
| 1000  | parts. |                                 |

Directions as for Pink.

## Light Blue.

|       |        |                             |
|-------|--------|-----------------------------|
| 689   | parts  | Water                       |
| 41    | „      | Wheat Starch                |
| 160   | „      | Tragacanth (60:1000)        |
| 100   | „      | Acetic Acid 30%             |
| 1     | „      | Thionine Blue GO            |
| 5     | „      | Tartaric Acid               |
| 4     | „      | Acetic Acid Tannin sol. 1:1 |
| <hr/> |        |                             |
| 1000  | parts. |                             |

Directions as for Pink.

## Methylene Blue.

|       |        |                                 |
|-------|--------|---------------------------------|
| 694   | parts  | Water                           |
| 35    | „      | Wheat Starch                    |
| 135   | „      | Tragacanth (60:1000)            |
| 100   | „      | Acetic Acid 30%                 |
| 5     | „      | Methylene Blue DBB extra        |
| 1     | „      | Marine Blue RI                  |
| 5     | „      | Tartaric Acid                   |
| 25    | „      | Acetic Acid Tannin solution 1:1 |
| <hr/> |        |                                 |
| 1000  | parts. |                                 |

Directions as for Pink.

## b) For the mangle.

These printing colours are made thinner and their consistency in comparison with those given under a) is reduced. After printing, the yarns are finished off as stated above. Red is printed on oil mordanted yarn, all other colours on unprepared material.

## Red.

|       |        |                           |
|-------|--------|---------------------------|
| 675   | parts  | Water                     |
| 120   | „      | Tragacanth (60:1000)      |
| 75    | „      | Acetic Acid 30%           |
| 10    | „      | Alizarine RX 40%          |
| 20    | „      | Alizarine 2RG 40%         |
| 50    | „      | Acetate of Lime 15° Tw    |
| 50    | „      | Acetate of Alumina 18° Tw |
| <hr/> |        |                           |
| 1000  | parts. |                           |

## Brown.

|       |        |                                         |
|-------|--------|-----------------------------------------|
| 635   | parts  | Water                                   |
| 135   | „      | Tragacanth (60:1000)                    |
| 40    | „      | Acetic Acid 30%                         |
| 80    | „      | Alizarine Orange N paste                |
| 10    | „      | Alizarine Blue SB powder                |
| 100   | „      | Acetate of Chrome 32 $\frac{1}{2}$ ° Tw |
| <hr/> |        |                                         |
| 1000  | parts. |                                         |

## Black.

|       |        |                                         |
|-------|--------|-----------------------------------------|
| 620   | parts  | Water                                   |
| 125   | „      | Tragacanth (60:1000)                    |
| 50    | „      | Acetic Acid 30%                         |
| 175   | „      | Noir reduit                             |
| 30    | „      | Acetate of Chrome 32 $\frac{1}{2}$ ° Tw |
| <hr/> |        |                                         |
| 1000  | parts. |                                         |

## Blue.

|       |        |                                         |
|-------|--------|-----------------------------------------|
| 843   | parts  | Water                                   |
| 125   | „      | Tragacanth (60:1000)                    |
| 15    | „      | Alizarine Blue SB powder                |
| 17    | „      | Acetate of Chrome 32 $\frac{1}{2}$ ° Tw |
| <hr/> |        |                                         |
| 1000  | parts. |                                         |

## Green I.

|       |        |                                         |
|-------|--------|-----------------------------------------|
| 610   | parts  | Water                                   |
| 135   | „      | Tragacanth (60:1000)                    |
| 50    | „      | Acetic Acid 30%                         |
| 100   | „      | Alizarine Yellow GG paste               |
| 5     | „      | Methylene Blue DBB extra                |
| 100   | „      | Acetate of Chrome 32 $\frac{1}{2}$ ° Tw |
| <hr/> |        |                                         |
| 1000  | parts. |                                         |

## Green II.

|       |        |                                    |
|-------|--------|------------------------------------|
| 665   | parts  | Water                              |
| 150   | „      | Tragacanth (60:1000)               |
| 100   | „      | Acetic Acid 30%                    |
| 8     | „      | Methylene Green extra yellow conc. |
| 8     | „      | Auramine conc. pat.                |
| 5     | „      | Tartaric Acid                      |
| 64    | „      | Acetic Acid Tannin sol. 1:1        |
| <hr/> |        |                                    |
| 1000  | parts. |                                    |

## Violet.

|       |        |                             |
|-------|--------|-----------------------------|
| 725   | parts  | Water                       |
| 150   | „      | Tragacanth (60:1000)        |
| 100   | „      | Acetic Acid 30%             |
| 2     | „      | Marine Blue BI              |
| 2     | „      | Methylene Violet 2RA conc.  |
| 5     | „      | Tartaric Acid               |
| 16    | „      | Acetic Acid Tannin sol. 1:1 |
| <hr/> |        |                             |
| 1000  | parts. |                             |

## W. WOOL PRINTING.

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### a) Colours classified according to their mode of fixing.

#### 1. Basic Colours.

Basic Colours are printed with a small amount of Acetic or other Organic Acids. Considerable quantities of Acids obviate a thorough fixing and also affect unfavourably the sharp outlines of the printed effect. These Colours are sometimes printed with additions of Tannin to the pastes in order to obtain effects which are faster to washing (for white goods); additions of Chloride of Tin or Bisulphite are rarely made. Materials, which undergo none or only a very slight chlorination, are sometimes printed with basic Colours. But the fastness of these colours (Methylene Blue) to light on woollen material is so small that their employment must be very limited.

Basic Colours are used however to a greater extent in combination with Acid Colours and Wood Extracts.

**Auramine** conc., O, I, II, pat.

**Phosphine**, all brands.

**Azo Phosphine** GO, BRO, pat.

**Chrysoidine** A cryst., C cryst., C extra cryst., **Vesuvine**, all brands, **Cutch Brown** D, G, **Dark Brown** M, MB.

**Magenta**, all brands, **Cerise**, all brands, **Grenadine**, all brands, **Maroon** O, extra, **Cardinal** R, G.

**New Magenta** O pat.

**Safranine** GGS, AN extra, O, conc., conc. B, **Methylene Violet**, all brands, **Methylene Heliotrope** O pat.

**Rosolane** pat., all brands.

**Cotton Scarlet** O.

**Methyl Violet**, all brands, **Violet cryst.** O.

**Victoria Blue** B.

**Malachite Green**, **Brilliant Green**, all brands.

**Methylene Green**, all brands.

**Methylene Indigo** O, SS, **Thionine Blue** GO, **Methylene Blue**, all brands, **Marine Blue**, all brands, **Methylene Dark-blue** RBN, 3BN.

**Fast Blue for Cotton**, all brands, **New Fast Blue** 3R cryst.

**Indamine Blue**, all brands, **Ethyl Blue** BF, BD, RD pat.

**Indophene Blue** B, G, 2B, pat.

**Methylene Grey**, all brands, **New Methylene Grey O**, **Nigrisine O**.

**Janus Blue G, B, R** pat., **Janus Darkblue R, B** pat.

**Janus Green B, G**, pat.

**Janus Black O, I, II** pat., **Janus Grey B, BB**.

**Janus Brown R, B** pat.

**Janus Red B** pat.

**Janus Yellow R, G**, pat.

## 2. Resorcine Colours.

These colours are seldom printed with Acids and mostly employed neutral or alkaline. The following ingredients are added to the printing pastes: Acetate of Soda, Phosphate of Soda, Soda, Ammonia, Oxalate of Ammonia, Tin Crystals.

**Uranine**, all brands.

**Eosine**, all brands.

**Erythrosine**, all brands.

**Phloxine**, all brands.

**Rose Bengale**, all brands.

**Rosazeine**, all brands.

## 3. Acid Colours.

These Colours are most suitable for wool printing on account of their fastness properties, simple application, and their very brilliant and full shades. They are mostly printed with Acid, and seldom applied neutral or alkaline. Acid ingredients are: Acetic Acid, Tartaric, Oxalic, Citric Acid, also their Ammonia salts, which in steaming give off the Ammonia and set free the Acid; likewise Alumina Salts, (Alum and Sulphate of Alumina) and Chloride of Tin. Alumina Salts are also sometimes used in order to convert colours, which equalize with difficulty and which are precipitated in the printing paste in a crystalline form by strong organic Acids, into fine precipitates, which are fixed as such in steaming (Scarlet B extra).

In other cases viz if the colour-acid is very insoluble and therefore liable to produce printing pastes which work badly, neutral additions or such as generate the Acid in steaming only (Oxalate of Ammonia) or even slightly alkaline additions are made. For light shades, especially if these are mixtures of several colours, small amounts of Ammonia often act favourably as regards equalizing.

The fastness to water of several Acid Colours f. i. Azo Acid Blue and Black, is unfavourably affected by the presence of alkaline salts. Therefore the addition of these salts to finishing pastes or the washing of the printed and steamed material in alkaline water (Soap, Soda) must be avoided.

**Acid Magenta**, all brands, **Acid Cerise O, II**, **Acid Maroon O, Maroon S**, **Orselline R, B**.

- Soluble Blue**, **Bleu de Lyon**, **Guernsey Blue**, **Opal Blue**, **Blackley Blue**, all brands, **Cloth Blue O**, **Full Blue O**, **Marine Blue V**, **Cotton Blue**, all brands, **Pure Blue**, all brands, **Cotton Light Blue O sol.**, **China Blue R**, 1, 2, **Alkaline Blue**, all brands, **Alkaline Violet O**.  
**Acid Violet 3RA**, **4RS**, **3RS**, **II**, **R conc.** new, **N**, **5BF**, **5BFI**, **7BN**, **Neutral Violet O**.  
**Acid Green O**, **D**, **M**, **conc.**, **conc. D**, **conc. M**, **II**, **Acid Green solution 5times conc.**  
**Patent Blue V**, **M**, **B**, **N**, **superior**, **J1**, **J2**, **J3**, **L**, **G**, **C**, **A**, **AJI**, **pat.**  
**Cyanine B**, **B conc.**, **pat.**  
**Keton Blue 4BN sol.**, **4BN powder**, **pat.**  
**Patent Green O**, **V**, **VS**, **pat.**  
**Naphthalene Green V**, **conc**, **pat.**, **Naphthalene Blue B**, **B extra**, **D**, **pat.**  
**Indigo Substitute B**, **BS**, **WE**, **B extra**, **BS extra**, **pat.**, **Patent Marine Blue pat.**  
**Acid Rosamine A** **pat.**  
**Fast Acid Red A** **pat.**  
**Fast Acid Violet B**, **R**, **A2R**, **pat.**  
**Fast Acid Blue R**, **R conc.**, **pat.**  
**Fast Acid Eosine G**, **G extra**, **pat.**, **Fast Acid Phloxine A**, **A extra**, **pat.**  
**Fast Acid Magenta G** **pat.**  
**Fast Blue O sol.**, **R**, **RR**, **3R extra**, **5R No. 60**, **D**, **G extra**, **5B**, **greenish**, **extra greenish**, **9845**, **Black Blue O**, **Black Black O**, **Fast Dark Blue R**, **Nigrosine I**, **II**, **III**, **IV**, **A**.  
**Azo Acid Magenta G**, **B** **pat.**, **Azo Acid Carmine B** **pat.**, **Alkali Fast Red R**, **B** **pat.**  
**Amido Naphthol Red G**, **6B**.  
**Chromotrope G**, **2R**, **2B**, **6B**, **7B**, **8B**, **10B**, **pat.**  
**Archil Substitute G** **pat.**  
**Victoria Violet 4BS**, **8BS** **pat.**, **Azo Acid Blue B** **pat.**  
**Azo Acid Black B**, **R**, **G**, **GR**, **GL**, **BL**, **3BL**, **3BL extra**, **TL conc.**, **TLII**, **TL extra**, **pat.**, **Naphthol Black D**, **Azo Black O**.  
**Amido Naphthol Black 4B**, **4B extra**, **6B**, **S**, **Alphyle Blue Black O**.  
**Chinoline Yellow O**, **extra**.  
**Naphthol Yellow S**, **SE**.  
**Azo Yellow conc.**, **O**, **R**, **Victoria Yellow O**, **double**, **conc.**, **Metanil Yellow extra**.  
**Flavazine S**, **L**, **T**.  
**Orange No. 4**, **No. 4LL**, **G**, **No. 2**, **2L**, **No. 1**, **O**, **No. 64**, **R**, **RR**, **Brilliant Orange O**, **G**, **R**.  
**Solid Brown O**, **yellow shade**, **NT**, **L**, **Azo Brown V**, **Naphthol Brown O**.  
**Scarlet G**, **GRII**, **R**, **RR**, **3R**, **3R extra**, **3R sup.**, **4R**, **5R**, **6R**, **B extra**, **M old**, **M new**, **GL**, **RL**, **2RL**, **3RL**, **Brilliant Lake Scarlet G**, **R**, **2R**, **Scarlet 6R cr.**  
**New Coccine O**, **Coccinine O**, **B**.  
**Victoria Scarlet 3G**, **2G**, **G**, **R**, **2R**, **2RB**, **3R**, **4R**, **5R**, **6R**, **RX**, **RRX**, **3RX**.  
**Brilliant Croceine** **yellow shade**, **blue shade**, **R**, **B**, **BB**, **3B**, **5B**.

Roccelline N, Fast Red O, S, SOO.

Brilliant Crimson O, B, Brilliant Rubine O, Victoria Rubine O, G.

Amaranth O, E.

Cloth Red O, Fast Claret Red O, Naphtho Rubine O, Naphthol Red O.

Claret Red G, R, B, 3 B, G extra, R extra, B extra, O.

#### 4. Mordant Colours.

These colours, which are distinguished for greater fastness than the Acid Colours, are principally used in slubbing and wool-yarn printing. For Wool prints they are used only, if very great fastness to light and washing is required (flag-printing). The brilliancy of the so produced effects is however considerably inferior to that of the acid colours and therefore the latter are often used for shading the mordant Colours.

The printing colours are prepared with Acetic, Oxalic etc. Organic Acids, with the addition of metal salts: Fluoride and Acetate of Chrome, Alumina salts etc.

After printing, the colours are fixed by steaming for 1—2 h.

Alizarine Orange, all brands.

Alizarine Red, paste and powder, all brands.

Alizarine Red 1WS.

Alizarine Claret R paste.

Alizarine Brown paste, all brands.

Alizarine Blue, all "S" (Bisulphite) brands.

Alizarine Green S, paste and powder.

Alizarine Yellow R, N, GG pat.

Mordant Yellow O.

Galleine, all brands.

Ceruleine, all "S" (Bisulphite) brands.

Acid Alizarine Green G pat.

Acid Alizarine Blue BB, GR pat.

Chromotrope 2 R, 2 B, 6 B, 8 B, 10 B, S, pat.

Vigoureux Yellow I.

Vigoureux Red I.

Vigoureux Brown I.

Vigoureux Black I pat.

Vigoureux Grey I pat.

Chromotrops, which dye wool direct (compare the notes under Acid Colours) are converted into considerably bluer and faster lakes (fast to light, washing and milling) if applied together with metal-mordants.

#### 5. Direct Dyeing Colours.

The direct colours can be printed on wool, but have a very limited application, since all the shades obtained with them are

surpassed in brilliancy and fastness by those produced with Acid Colours. They are fixed with Phosphate of Soda.

**Oxydianil Yellow O, Aurophenine O, Cresotine Yellow G.**  
**Dianil Yellow**, all brands, pat., **Dianil Direct Yellow S.**

**Dianil Orange G** pat., N, **Toluylene Orange R.**

**Dianil Red R**, 4 B, 10 B, **Dianil Claret Red B**, G.

**Dianil Scarlet G**, 2 R, pat., **Brilliant Dianil Red R**, Delta  
**Purpurine 5 B.**

**Dianil Blue**, all brands, pat., **Dianil Indigo O** pat.

**Dianil Green G** pat.

**Dianil Dark Blue R**, 3 R, pat.

**Dianil Brown**, all brands, **Dianil Japonine O**, **Dianil Copper**  
**Brown O**, **Dianil Fast Brown B.**

**Dianil Black**, all brands, pat., **Dianil New Black LBI** pat.

## b) Colours, classified according to their suitability for different applications.

### 1. Printing of pieces.

#### a) Operations before printing.

Before printing the pieces must be suitably prepared in order to make the wool fibre more adapted to taking up the colour.

The preparation of the goods consists of: I. Bleaching, II. Chlorinating, III. Treating with Stannates.

#### I. Bleaching.

The process used most generally for bleaching wool is founded upon the application of Sulphurous Acid, in its gaseous form (burning sulphur in closed stoves) or in the form of Sodium Bisulphite. In the latter case the pieces, which must have been properly cleansed in alkaline baths, and then washed and squeezed, are passed alternately through Bisulphite and Muriatic Acid baths, or they are padded with a diluted solution of Sodium Bisulphite and steamed for a short time.

Another process, which is often combined with the Bisulphite method, is founded upon the application of Peroxide of Hydrogen. In this case the pieces are impregnated with a diluted Peroxide of Hydrogen solution before being passed through the Bisulphite and then washed after being left to lie for a night.

#### II. Chlorinating.

After bleaching, the goods are washed, squeezed and passed through a very diluted, strongly acidified Chloride of lime solution; they are then again washed and squeezed.

The Chloride of lime solution must be kept weak and the length of time during which the pieces pass through it, must be so regulated, that there is no danger of making the goods look yellow. Moreover a surplus of Acid ought always to be present in the Chlorine-bath, in order to prevent the fabric from appearing yellow after steaming.

### III. Mordanting with Stannates.

The chlorinated material is passed through a solution of Stannate of Soda (about  $4\frac{1}{2}$ —9° Tw) and then the Tin mordant fixed in a weak acid bath. The pieces are then well washed and dried.

For muslin de laine, which is mostly used for print styles, the following series of processes is suitable.

1. Bleaching: 1 part Bisulphite cryst. dissolved in  
3 parts Water. After padding the  
pieces are steamed for 5 min., washed  
and squeezed.
2. Chlorinating: 100 parts cold Water  
2 „ Chloride of Lime sol. 32 $\frac{1}{2}$ ° Tw  
3 „ Muriatic Acid 36° Tw.

The pieces are passed through this liquid for 15—20 sec. The bath is refreshed, according to its getting weakened, with about the double amounts of Chloride of lime and Muriatic Acid in the same volume of Water. Then washing and squeezing.

#### 3. Tin Mordanting.

- a) Stannate bath: Stannate of Soda sol. 4 $\frac{1}{2}$ ° Tw. One passage;  
squeezing.
- b) Acid bath: 100 parts cold Water  
1 $\frac{1}{2}$  „ Muriatic Acid 36° Tw.

All these baths are applied in roller cisterns. The chlorinating apparatus must be built from material which withstands Acid and Chlorine and must be provided with a ventilator.

The order of the operations may be altered and the mordanting with Stannate of Soda can be dispensed with. The most important operation is the treatment with Chlorine.

A good bleach with alternate Chloride of lime and Bisulphite baths is carried out in the following manner:

1. The pieces are washed for  $\frac{1}{2}$  h in rope form in hot water  
and then
2. soaped for  $\frac{1}{2}$  h at 140° F (2 parts per 1000 liq.).

After well rinsing, and squeezing, the goods are passed continuously through

1. Bisulphite 13 $\frac{1}{2}$ ° Tw
2. Chloride of Lime 2.8° Tw
3. Bisulphite 13 $\frac{1}{2}$ ° Tw
4. Chloride of Lime 2.8° Tw
5. Sulphuric Acid 2.8° Tw.

The pieces are squeezed between each separate immersion by means of squeezing rollers attached to the cisterns. They are then



rolled up and left to lie over night. Then washed, dried, passed through Glycerine and dried.

The last operation makes the wool fibre more adapted to taking up the printed colour and also acts favourably for the subsequent steaming process (Glycerine being very hygroscopic).

Another method is to treat the goods with Stannate first and then to chlorinate them.

The cleansed and squeezed pieces are passed twice through Stannate of Soda 9° Tw; then for 15 sec. at full width through Sulphuric Acid 2° Tw; then through Hypochloric Acid 1.4° Tw; finally they are washed and dried on a frame.

### **b) Direct print on Woollen cloth.**

Woollen goods are printed direct either by block or by machine.

Machine printing is carried on continuously (Rouleaux) or also disconnectedly like block printing. Since in the Rouleaux machines there are no so-called rapports, the colours used for this purpose need not to equalize as well as colours used for block printing. Therefore nearly all Wool Colours are suitable for machine printing.

## **1. Machine printing.**

For heavy patterns (blotch-prints) the rollers must be deeply engraved and the cylinder properly wrapped ("lapped"). It is very important not to dry the pieces too sharply, but to let them enter the steambox rather damp.

For this purpose the goods are sprinkled slightly before printing and then after printing wrapped into wrappers (end cloths) without drying; or they are slightly dried and then hung up in a damp place; or they are rolled into moist wrappers, containing 5—12% or more moisture, which is ascertained by their weight.

The steaming operation is generally carried out without pressure in wooden steam boxes; but iron or brick steaming apparatus may also be used, if care is taken, that the steam enters the apparatus moist.

This is obtained by letting the steam pass through a moistening apparatus (an iron cylinder partly filled with water) and also through a water tank attached to the bottom of the steam box. The colours turn out the brighter and fuller, the more moisture is present in steaming.

To judge the steam pressure each steaming apparatus ought to contain a water-gauge, and the pressure ought never to rise above 5—10 ccm.

It is advisable moreover, in order to prevent the steam pressure from rising suddenly, to affix a simple valve between the steambox and the steam pipe, which can automatically close the entrance (water-valve). The goods are steamed for 1—2 h. according to the depth of the design and the colours.

In many cases, especially for light (floral or conventional designs) the pieces are slightly dried, after printing, steamed for 1 h with moist steam; then moistened by wrapping them in damp end cloths or by hanging them in a damp, cool place; and finally steamed again for another  $\frac{1}{2}$  h.

After steaming the pieces are rinsed, if possible in running water. Care must be taken not to soil the white with some of the colour, which is being washed off. The soiling takes place easier, if soft or warm water is used for washing. If only soft and rather warm water (in summer) is obtainable, then it is necessary to add certain salts (Common, Glauber's salts etc.) to the washing cisterns.

### Basic Colours.

|                             | 1.          | 2.          |
|-----------------------------|-------------|-------------|
| Colouring Matter            | 20 parts    | 20 parts    |
| Acetic Acid 12° Tw          | 100 „       | 100 „       |
| Water                       | 100 „       | 100 „       |
| Tragacanth (60:1000)        | 500 „       | 500 „       |
| British Gum                 | 150 „       | 150 „       |
| Tartaric Acid               | 20 „        | 20 „        |
| Water                       | 110 „       | 70 „        |
| Acetic Acid Tannin sol. 1:1 | —           | 40 „        |
|                             | 1000 parts. | 1000 parts. |

Suitable for all basic dyes.

### Orange.

|             |                  |
|-------------|------------------|
| 30 parts    | Colouring Matter |
| 210 „       | Water            |
| 650 „       | Gum Solution     |
| 30 „        | Oxalic Acid      |
| 80 „        | Water            |
| 1000 parts. |                  |

For all brands of Orange and Brilliant Orange.

### Scarlet.

|             |                           |
|-------------|---------------------------|
| 30 parts    | Colouring Matter          |
| 300 „       | Water                     |
| 500 „       | Tragacanth (60:1000)      |
| 100 „       | British Gum               |
| 20 „        | Tartaric Acid             |
| 50 „        | Acetate of Alumina 15° Tw |
| 1000 parts. |                           |

For all brands of Scarlet and Victoria Scarlet.

### Scarlet 6R cryst.

|             |                           |
|-------------|---------------------------|
| 10 parts    | Colouring Matter          |
| 270 „       | Water                     |
| 500 „       | Tragacanth (60:1000)      |
| 150 „       | Dark burnt Starch         |
| 20 „        | Tartaric Acid             |
| 50 „        | Acetate of Alumina 15° Tw |
| 1000 parts. |                           |

## Amaranth.

|          |                        |
|----------|------------------------|
| 30 parts | Colouring Matter       |
| 210      | „ Water                |
| 500      | „ Tragacanth (60:1000) |
| 150      | „ British Gum          |
| 30       | „ Oxalic Acid,         |
| 80       | „ Water                |
| <hr/>    |                        |
| 1000     | parts.                 |

Suitable for Amaranth, Naphthol Red and Victoria Rubine.

## Scarlet B extra.

|          |                                  |
|----------|----------------------------------|
| 40 parts | Scarlet B extra                  |
| 500      | „ Cold water                     |
| 300      | „ British Gum, boil and add hot: |
| 50       | „ Alum powder                    |
| 110      | „ Water                          |
| <hr/>    |                                  |
| 1000     | parts.                           |

## Chromotrop.

|          |                        |
|----------|------------------------|
| 30 parts | Colouring Matter       |
| 220      | „ Water                |
| 500      | „ Tragacanth (60:1000) |
| 100      | „ British Gum          |
| 30       | „ Oxalic Acid          |
| 20       | „ Tartaric Acid        |
| 100      | „ Water                |
| <hr/>    |                        |
| 1000     | parts.                 |

Suitable for Chromotrop 2R, 2B, 6B, 8B, 10B. An addition of Alumina or Chrome salts renders the shade considerably darker. (See Mordant Colours page 192).

## Rosazeine.

|          |                                       |
|----------|---------------------------------------|
| 40 parts | Colouring Matter                      |
| 75       | „ Acetic Acid 9° Tw                   |
| 125      | „ Hot Water                           |
| 610      | „ Gum Solution, when cooled down add: |
| 10       | „ Oxalic Acid                         |
| 20       | „ Oxalate of Ammonia                  |
| 20       | „ Tin Chloride 142° Tw                |
| 100      | „ Water                               |
| <hr/>    |                                       |
| 1000     | parts.                                |

Suitable for all brands of Rosazeine.

## Eosine.

|                  | 1.                | 2.                |
|------------------|-------------------|-------------------|
| Colouring Matter | 10 parts          | 10 parts          |
| Water            | 100 „             | 100 „             |
| Sodium Phosphate | —                 | 40 „              |
| Gum Solution 1:1 | 730 „             | 730 „             |
| Soda             | 10 „              | —                 |
| Tin crystals Ia  | —                 | 20 „              |
| Water            | 150 „             | 100 „             |
|                  | <hr/> 1000 parts. | <hr/> 1000 parts. |

Suitable for all brands of Eosine, Erythrosine, Phloxine, Rose Bengale, Rosazeine, Uranine. The addition of Tin Crystals produces

bright shades of a yellowish tinge, which bleed less into white, than those obtained with soda. Sodium Acetate may be used instead of Sodium Phosphate.

### Acid Violet.

|                     | 1.          | 2.          | 3.          |
|---------------------|-------------|-------------|-------------|
| Colouring Matter    | 30 parts    | 30 parts    | 30 parts    |
| Water               | 150 „       | 150 „       | 150 „       |
| Gum solution 1:1    | 650 „       | 650 „       | 650 „       |
| Oxalic Acid         | — „         | 10 „        | 30 „        |
| Sulphate of Alumina | 30 „        | 30 „        | — „         |
| Water               | 140 „       | 130 „       | 140 „       |
|                     | 1000 parts. | 1000 parts. | 1000 parts. |

Suitable for all brands of Acid Violet, Acid Green, Fast Acid Violet, Fast Acid Blue, Fast Acid Phloxine, Fast Acid Eosine and Fast Acid Magenta.

### Flavazine T, S, L.

|                      | 1.          | 2.          |
|----------------------|-------------|-------------|
| Colouring Matter     | 40 parts    | 40 parts    |
| Water                | 200 „       | 200 „       |
| Gum sol. 1:1         | 600 „       | 600 „       |
| Alum                 | 30 „        | — „         |
| Oxalic Acid          | 15 „        | 10 „        |
| Oxalate of Ammonia   | — „         | 20 „        |
| Tin Chloride 142° Tw | — „         | 20 „        |
| Water                | 115 „       | 110 „       |
|                      | 1000 parts. | 1000 parts. |

### Induline.

|             |                      |
|-------------|----------------------|
| 40 parts    | Colouring Matter     |
| 400 „       | Boiling Water        |
| 400 „       | Tragacanth (60:1000) |
| 110 „       | British Gum          |
| 50 „        | Ammonia              |
| 1000 parts. |                      |

For all brands of Induline and Fast Blue.

### Alkaline Blue.

|             |                  |
|-------------|------------------|
| 30 parts    | Colouring Matter |
| 150 „       | Hot Water        |
| 600 „       | Gum solution 1:1 |
| 60 „        | Oxalic Acid      |
| 160 „       | Water            |
| 1000 parts. |                  |

Suitable for all brands of Alkaline Blue, Soluble Blue, Full Blue, Opal Blue, Cotton Blue, Pure Blue, &c.

### Patent Blue.

|             |                  |
|-------------|------------------|
| 30 parts    | Colouring Matter |
| 230 „       | Water            |
| 600 „       | Gum solution 1:1 |
| 20 „        | Oxalic Acid      |
| 20 „        | Tartaric Acid    |
| 100 „       | Water            |
| 1000 parts. |                  |

Suitable for Patent Blue, Cyanine and Indigo Substitute.

## Azo Acid Black.

|          |                                              |
|----------|----------------------------------------------|
| 60 parts | Colouring Matter                             |
| 20 "     | Glycerine                                    |
| 360 "    | Boiling Water                                |
| 150 "    | British Gum powder                           |
| 350 "    | Tragacanth (60:1000)                         |
| 20 "     | Turpentine                                   |
| 40 "     | Oxalic Acid (or 50 parts Oxalate of Ammonia) |

1000 parts.

Suitable for all Azo Acid Blacks.

## Chromotrop-Black I.

|          |                                            |
|----------|--------------------------------------------|
| 25 parts | Chromotrop S pat.                          |
| 33 "     | Chromotrop 6 B pat.                        |
| 1 "      | Patent Blue V pat.                         |
| 1 "      | Victoria Yellow conc.                      |
| 450 "    | Boiling Water                              |
| 300 "    | British Gum powder, when cooled down, add; |
| 100 "    | Neutral Chromate of Ammonia                |
| 50 "     | Chloride of Ammonia                        |
| 20 "     | Glycerine                                  |
| 20 "     | Turpentine                                 |

1000 parts.

## Victoria Blue.

|          |                       |
|----------|-----------------------|
| 20 parts | Victoria Blue B       |
| 40 "     | Alcohol               |
| 160 "    | Water                 |
| 600 "    | Gum sol. 1:1          |
| 20 "     | Oxalic Acid           |
| 40 "     | Oxalate of Ammonia    |
| 20 "     | Chloride of Tin solid |
| 100 "    | Water                 |

1000 parts.

## Victoria Violet.

|          |                      |
|----------|----------------------|
| 40 parts | Colouring Matter     |
| 240 "    | Water                |
| 400 "    | Tragacanth (60:1000) |
| 180 "    | Dark burnt Starch    |
| 40 "     | Oxalate of Ammonia   |
| 100 "    | Water                |

1000 parts.

For Victoria Violet, Azo Acid Blue, Naphthalene Blue, Naphthalene Green

## Chromotrop-Navy Blue.

|          |                                   |
|----------|-----------------------------------|
| 25 parts | Chromotrop 6 B pat.               |
| 12 "     | Patent Blue V pat.                |
| 3 "      | Acid Violet N                     |
| 240 "    | Boiling Water                     |
| 650 "    | British Gum Thickening (page 212) |
| 50 "     | Sulphate of Alumina               |
| 20 "     | Oxalic Acid                       |

1000 parts.

For Chromotrop 6 B, 8 B, 10 B.

## Chromotrop-Black II.

|             |                                                  |
|-------------|--------------------------------------------------|
| 56 parts    | Chromotrop 6 B pat.                              |
| 12 „        | Patent Blue V pat.                               |
| 8 „         | Victoria Yellow conc.                            |
| 434 „       | Water                                            |
| 350 „       | British Gum powder; boil, cool down,<br>and add: |
| 50 „        | Chloride of Ammonia                              |
| 50 „        | Fluoride of Chrome                               |
| 20 „        | Glycerine                                        |
| 20 „        | Turpentine                                       |
| <hr/>       |                                                  |
| 1000 parts. |                                                  |

For Chromotrop 6 B, 8 B, 10 B.

## Alizarine Red.

|             |                     |
|-------------|---------------------|
| 25 parts    | Alizarine Red 1WS   |
| 555 „       | Boiling water       |
| 260 „       | British Gum         |
| 40 „        | Sulphate of Alumina |
| 20 „        | Oxalic Acid         |
| 100 „       | Water               |
| <hr/>       |                     |
| 1000 parts. |                     |

## Alizarine Blue, shaded.

|             |                                         |
|-------------|-----------------------------------------|
| 40 parts    | Alizarine Blue SB                       |
| 260 „       | Water                                   |
| 3 „         | Patent Blue A pat.                      |
| 7 „         | Fast Acid Violet A 2 R pat.             |
| 30 „        | Alcohol                                 |
| 50 „        | Water                                   |
| 500 „       | Dark burnt Starch Thickening            |
| 30 „        | Tartaric Acid                           |
| 80 „        | Acetate of Chrome 32 $\frac{1}{2}$ ° Tw |
| <hr/>       |                                         |
| 1000 parts. |                                         |

## 2. Block printing.

A very important point in block printing is the production of a smooth, even surface print, viz the "rappports" must not become visible on the printed effect. The less affinity a certain colour possesses for wool at the ordinary temperature the more level dyeing results will this colour generally produce. In order to gauge the equalizing property of a colour, a small strip of cloth is printed with the printing paste and then washed after a few minutes in clean water. The less colour remains on the fibre in washing, the better this dyestuff equalizes in steaming. Not all colours, which are suitable for machine printing can be used for printing blotch or conventional effects by block. The most important Colours for light floral and conventional designs are:

**Auramine, Phosphine, Azophosphine.**

**Magenta, Methyl Violet, Brilliant Green, Malachite Green, Victoria Blue.**

**Uranine, Eosine, Phloxine, Erythrosine, Rose Bengale.  
Chinoline Yellow, Flavazine.  
Scarlet, Victoria Scarlet, Amaranth.**

To block printing colours such ingredients are added as prevent the colours from rushing on too quickly and producing unlevel results. These additions (sometimes producing a lake-formation within the printing paste and thus retarding the dyeing) are: Bisulphite, Sodium Tungstate, Chloride of Tin, Tin Cryst. and Phosphate of Soda. Additions of Tin generally increase the fastness to water of the printed effect.

Besides the dyestuffs, named above as suitable for floral effects, the other colours mentioned as suitable for machine printing, can be used for dark shades.

The following recipes may serve as an instance for preparing light block printing pastes.

#### Eosine.

|          |                        |
|----------|------------------------|
| 20 parts | Colouring Matter       |
| 230 "    | Water                  |
| 600 "    | Gum sol. 1:1           |
| 40 "     | Acetate of Soda cryst. |
| 60 "     | Water                  |
| 20 "     | Tin cryst. Ia.         |
| 30 "     | Water                  |

1000 parts.

Phosphate of Soda may be used instead of Acetate, for all brands of Eosine, Phloxine, Erythrosine, Rose Bengale, Uranine.

#### Victoria Blue.

|          |                         |
|----------|-------------------------|
| 20 parts | Victoria Blue B         |
| 40 "     | Spirit                  |
| 240 "    | Water                   |
| 400 "    | Gum sol. 1:1            |
| 10 "     | Oxalic Acid.            |
| 20 "     | Oxalate of Ammonia      |
| 200 "    | Water                   |
| 20 "     | Chloride of Tin 142° Tw |
| 50 "     | Water                   |

1000 parts.

#### Fast Acid Eosine.

|          |                           |
|----------|---------------------------|
| 20 parts | Colouring Matter          |
| 155 "    | Boiling Water             |
| 250 "    | Gum                       |
| 5 "      | Oxalic Acid               |
| 10 "     | Oxalate of Ammonia        |
| 10 "     | Chloride of Tin 142° Tw   |
| 100 "    | Water                     |
| 450 "    | Thickening for Reductions |

1000 parts.

For all brands of Rosazeine, Fast Acid Eosine, Fast Acid Phloxine, Fast Acid Magenta.

## Thickening for Reductions.

|       |        |                         |
|-------|--------|-------------------------|
| 500   | parts  | Gum sol. 1:1            |
| 12    | „      | Oxalic Acid             |
| 24    | „      | Oxalate of Ammonia      |
| 24    | „      | Chloride of Tin 142° Tw |
| 24    | „      | Tungstate of Soda       |
| 416   | „      | Boiling Water           |
| <hr/> |        |                         |
| 1000  | parts. |                         |

## c) Discharge and Resist Prints on Woollen cloths.

For discharge prints the cloth is dyed with dischargeable colours and then the Tin or Zinc dust Discharge paste printed.

For Resist styles the Tin salt or Zinc dust colours are printed upon the material and the latter then over-printed with thickened Colour solution. The Tin salt and Protoxide of Tin-Acetate-Discharges for Wool can be made considerably stronger than those applied to cotton and thus a better discharge effect and purer Whites are obtained. The following ingredients are used as additions to Tin salt Discharges: Tartaric, Citric, Oxalic Acid, Acetine; less frequently are added small amounts of Muriatic Acid, also Sulphocyanide of Ammonia and Acetate of Soda, the latter two additions being especially made to Coloured Discharges.

## Tin Discharges.

The following colours are discharged with Tin salt:

## a) Ground Colours for white effects.

**Flavazine S, L, T, Azo Yellow, Metanil Yellow extra.**

**Orange No. 2, 4, G.**

**Scarlet**, especially the bluish brands (see the tables on page 213).

**Victoria Violet, Azo Acid Blue.**

## b) Ground Colours for coloured effects.

**Naphthol Yellow S, SE.**

**Azo Yellow**, all brands, **Flavazine S, L, T.**

**Victoria Yellow, Metanil Yellow**, all brands.

**Chrysoine G.**

**Orange**, all brands, **Brilliant Orange extra.**

**Scarlet, Victoria Scarlet**, all brands.

**Scarlet 6R cryst., New Coccine O.**

**Coccinine O, B.**

**Brilliant Croceine**, all brands.

**Fast Red O, S.**

**Brilliant Crimson O.**

**Victoria Rubine O, Amaranth O, Cloth Red O.**

**Naphthol Red O, B.**

**Claret Red**, all brands.

**Victoria Violet, Azo Acid Blue**, all brands.

**Azo Acid Black**, all brands.

**Chromotrop 2R, 2B, 6B, 8B, 10B** (see tables on page 213).



The following colours can be used as coloured tin salt discharges :

All brands of Auramine, Magenta, Cerise, Grenadine, Maroon, Phosphine, Methyl Violet, Brilliant Green, Malachite Green, Methyl Alkaline Blue, Alkaline Blue, Opal Blue, Full Blue, Purple Blue, Bleu de Lyon, Cotton Blue, Guernsey Blue, Acid Violet, Patent Blue, Cyanine, Naphthalene Blue, Naphthalene Green, Victoria Blue, Eosine, Phloxine, Rosazeine, Fast Acid Eosine, Fast Acid Phloxine, Fast Acid Magenta, Fast Acid Violet, Fast Acid Blue, Chinoline Yellow.

### Discharge White.

|                          | 1.          | 2.          | 3.          |
|--------------------------|-------------|-------------|-------------|
| Acid Starch              | 500 parts   | 500 parts   | 500 parts   |
| Acetic Acid 9° Tw        | 100 „       | 100 „       | 100 „       |
| Tin salt Ia cryst.       | 225 „       | 225 „       | 225 „       |
| Citric Acid              | — „         | — „         | 50 „        |
| Acetate of Soda cryst.   | — „         | 100 „       | — „         |
| Sulphocyanide of Ammonia | — „         | — „         | 75 „        |
| Water                    | 175 „       | 75 „        | 50 „        |
|                          | 1000 parts. | 1000 parts. | 1000 parts. |

### Discharge Yellow.

|             |                        |
|-------------|------------------------|
| 60 parts    | Chinoline Yellow O     |
| 150 „       | Boiling Water          |
| 500 „       | Acid Starch            |
| 200 „       | Tin salt Ia cryst.     |
| 70 „        | Acetate of Soda cryst. |
| 20 „        | Citric Acid            |
| 1000 parts. |                        |

### Discharge Pink.

|             |                        |
|-------------|------------------------|
| 40 parts    | Rosazeine extra pat.   |
| 170 „       | Boiling Water          |
| 500 „       | Acid Starch            |
| 200 „       | Tin salt Ia cryst.     |
| 70 „        | Acetate of Soda cryst. |
| 20 „        | Citric Acid            |
| 1000 parts. |                        |

### Discharge Red.

|             |                                          |
|-------------|------------------------------------------|
| 80 parts    | Eosine 2B                                |
| 48 „        | Phloxine O                               |
| 182 „       | Water                                    |
| 200 „       | Gum solution 1:1, dissolve hot and add : |
| 200 „       | British Gum                              |
| 200 „       | Tin salt Ia cryst.                       |
| 70 „        | Acetate of Soda cryst.                   |
| 20 „        | Citric Acid                              |
| 1000 parts. |                                          |

## Discharge Blue, light.

|             |                          |
|-------------|--------------------------|
| 10 parts    | Victoria Blue B          |
| 200         | „ Water                  |
| 500         | „ Acid Starch (page 126) |
| 200         | „ Tin salt Ia cryst.     |
| 70          | „ Acetate of Soda cryst. |
| 20          | „ Citric Acid            |
| <hr/>       |                          |
| 1000 parts. |                          |

## Discharge Blue, dark.

For Blue upon Red (upon woollen material dyed with 3% New Coccine O).

|             |                        |
|-------------|------------------------|
| 25 parts    | Acid Violet N          |
| 40          | „ Alcohol              |
| 80          | „ Water                |
| 360         | „ Tragacanth (60:1000) |
| 140         | „ Dark burnt Starch    |
| 40          | „ Fast Blue 5 B        |
| 150         | „ Water                |
| 30          | „ Oxalic Acid          |
| 75          | „ Water                |
| 60          | „ Tin salt Ia cryst.   |
| <hr/>       |                        |
| 1000 parts. |                        |

## Discharge Green.

|             |                          |
|-------------|--------------------------|
| 40 parts    | Naphthalene Green V pat. |
| 170         | „ Acetic Acid 6° Tw      |
| 500         | „ Acid Starch (page 126) |
| 200         | „ Tin salt Ia cryst.     |
| 70          | „ Acetate of Soda cryst. |
| 20          | „ Citric Acid            |
| <hr/>       |                          |
| 1000 parts. |                          |

## Zinc dust discharges.

The following Colours can be discharged with Zinc Dust.

a) Ground Colours for White Discharges:

**Victoria Yellow**, all brands.

**Orange No. 4, No. 2, G, Brilliant Orange**, all brands.

**Scarlet**, all brands, especially the blue shades.

**Victoria Scarlet**, especially the blue shades.

**New Coccine O, Fast Red O, S.**

**Claret Red**, all brands, **Brilliant Crimson O.**

**Victoria Rubine O, Amaranth O, Naphthol Red O.**

**Acid Magenta**, all brands.

**Alkaline Blue**, all brands, **Methyl Alkaline Blue MLB.**

**Guernsey Blue O, Bleu de Lyon**, all brands, **Full Blue O,**

**Purple Blue O, Blue red shade, Blue blue shade.**

**Acid Green**, all brands.

**Patent Blue**, all brands, pat., **Cyanine B pat.**

**Keton Blue 4BN**, sol. and powder, pat.

**Naphthalene Blue B pat., Naphthalene Green V, conc., pat.**

## b) Ground Colours for Coloured Discharges:

The colours mentioned under a) and the following dyes:

**Naphthol Yellow S, SE.**

**Azo Yellow**, all brands.

**Scarlet G, Scarlet 6R** cryst., **Scarlet B** extra.

**Victoria Scarlet**, yellowish brands.

Coloured Zinc dust discharges are obtained with **Chinoline Yellow, Safranine, Methylene Violet, Methylene Blue.**

The Zinc dust discharges produce a purer white than Tin salt discharges, and a series of colours which withstand Tin discharges are easily discharged with Zinc dust (cf. tables on page 213).

For preparing the Zinc dust discharge paste the best Zinc dust in its finest powder-form must be selected. In machine printing a brush furnisher must be used for Zinc dust Discharges, while there are no difficulties in working them for block-application. Furthermore care must be taken not to produce over-pressure in steaming Zinc dust discharges, since the latter injure the wool fibre if that is the case. The steaming operation must therefore be carried out most carefully, and is best regulated by an installation as described on page 195).

The preparation of Zinc dust discharges is considerably varied in practice. The more Bisulphite there is present, the better the discharge result will be; (but the more unstable becomes the printing paste).

In order to make the Bisulphite more stable within the printing paste, Formic Aldehyde, Acetaldehyde or Aceton are added to it.

## Discharge White I.

|             |                                                              |
|-------------|--------------------------------------------------------------|
| 300 parts   | Zinc Dust finely powdered are ground with                    |
| 500 „       | Gum solution 1:1                                             |
| 50 „        | Glycerine                                                    |
| 100 „       | Bisulfite of Soda 64° Tw; after the reaction has taken place |
| 50 „        | Ammonia are added                                            |
| 1000 parts. |                                                              |

## Discharge White II.

|             |                                                        |
|-------------|--------------------------------------------------------|
| { 22 parts  | Dextrine are dissolved in                              |
| { 500 „     | Bisulfite 66½° Tw, cooled and                          |
| 350 „       | Zinc Dust finely powdered are gradually added; further |
| 28 „        | Soda calc.                                             |
| 100 „       | Glycerine                                              |
| 1000 parts. |                                                        |

## Discharge White III.

|             |                                                               |
|-------------|---------------------------------------------------------------|
| 250 parts   | Zinc Dust, finely powdered, are ground up with                |
| 200 „       | Gum solution 1:1 and slowly added whilst cooling:             |
| 400 „       | Bisulphite of Soda 66½° Tw; when the reaction has taken place |
| { 30 „      | Soda                                                          |
| { 70 „      | Water                                                         |
| { 50 „      | Glycerine are added                                           |
| 1000 parts. |                                                               |

## Discharge White IV.

|      |        |                                                                                              |
|------|--------|----------------------------------------------------------------------------------------------|
| 250  | parts  | Zinc Dust, finely powdered, are ground with                                                  |
| 230  | „      | Gum solution 1:1, and whilst cooling                                                         |
| 400  | „      | Bisulphite of Soda 66 $\frac{1}{2}$ ° Tw are slowly added. When the reaction has taken place |
| 70   | „      | Formaldehyde 40% and                                                                         |
| 50   | „      | Glycerine are added                                                                          |
| 1000 | parts. |                                                                                              |

## Resist Printing Colour.

The following resist can be recommended:

|      |        |                          |
|------|--------|--------------------------|
| 540  | parts  | Gum solution 1:1         |
| 360  | „      | Zinc Dust, finely ground |
| 100  | „      | China Clay               |
| 1000 | parts. |                          |

## 2. Wool yarn printing.

Wool yarns are printed in order to produce fancy effects in the manufacture of carpets, hosiery etc. The mode of working, as regards printing and finishing the yarns, is identical with the one described for piece goods.

Worsted, Carpet, Knitting and Zephyr yarns are used for this purpose; they are generally chlorinated before printing in order to make them take up the printed colour more readily.

Before printing the yarn is cleansed: it is steeped over night in water of 122° F. After this "scalding" operation the yarn is washed at 113° F with 3 parts of Soda and 4 parts of Soap per 100 parts; it is then stoved in its moist state for 5—6 h in the sulphur chamber; then well rinsed and chlorinated in the following manner:

100 parts of yarn are treated in a bath containing the 10—12 fold amount of water, to which are added 6 parts of Sulphuric Acid 168 $\frac{1}{2}$ ° Tw. The yarn is worked for  $\frac{1}{4}$  h and then gradually — within  $\frac{3}{4}$  h — 12 parts of Chloride of Lime solution 1.4° Tw are added to the bath. The bath is kept cold throughout. Then the yarn is soured with 6 parts of Sulphuric Acid, well rinsed until all the acid is removed (Congo Red reaction) and finally slowly dried at 113—122° F.

If Glycerine is added to the last rinsing bath the adaptability of the fibre for taking up the printed colours is enhanced.

The selection of dyestuffs suitable for printing on yarn depends upon the purpose which the yarn is meant for: the fastness to light, washing, milling, acids and stoving being the principal guide in this choice. We beg to refer to the colours named on pages 12—24 and also to the classification of dyestuffs in the following chapter on Vigoureux printing (slubbing).

For Worsted yarns the following colours, fast to stoving and milling, are suitable.

**Flavazine T, Oxy Dianil Yellow O, Rosazeine, Phloxine, Acid Rosamine A, Fast Acid Eosine G, Fast Acid Phloxine**

A, Fast Acid Magenta G, Fast Acid Violet, Fast Acid Blue, Acid Violet 5BF, Patent Blue A, Scarlet 4R, Alizarine Yellow GGW, Alizarine Blue "S"-brands, Vigoureux Black I, Vigoureux Grey, Vigoureux Red, Vigoureux Brown, Vigoureux Yellow.

For Carpet yarns the following dyestuffs are principally used, on account of their fastness to light.

Flavazine S, L, T, Victoria Yellow, Orange G, R, Brilliant Orange, Scarlet 4R, B extra, Victoria Scarlet, Brilliant Crimson, Cloth Red O, Chromotrop, Azo Acid Magenta, Azo Acid Carmine, Fast Acid Eosine, Fast Acid Phloxine, Fast Acid Magenta, Fast Acid Violet, Patent Blue, Naphthalene Green, Azo Acid Blue, Azo Acid Black "L"-brands, Mordant Yellow, Alizarine Yellow GGW, Alizarine Orange, Alizarine Claret, Alizarine Brown, Alizarine Blue SB, Alizarine Red 1WS, and the Vigoureux Colours.

The yarns are mostly printed on the 2 or more colour printing machine or on the mangle, in rare cases the "iron machine" is used.

"Chine" prints for Iris-effects on Carpet yarns are generally produced by block. The colours are thickened with Tragacanth, Gum Arabic, British Gum or Leigomme; Dextrine which has reducing properties is very rarely used. The most convenient thickening agent is Tragacanth, the consistency of which can be enhanced by an addition of British Gum or Gum Arabic.

After printing, the yarn is slightly dried, wrapped in moist linen or Jute end cloths, steamed for 1–2 h in very moist steam, well rinsed and finally soaped if required (1:1000).

#### Yellow I.

|             |                      |
|-------------|----------------------|
| 25 parts    | Naphthol Yellow S    |
| 695 "       | Water                |
| 60 "        | Acetic Acid 12° Tw   |
| 200 "       | Tragacanth (60:1000) |
| 20 "        | Glycerine            |
| 1000 parts. |                      |

#### Yellow II.

|             |                      |
|-------------|----------------------|
| 20 parts    | Flavazine T          |
| 550 "       | Water                |
| 60 "        | Acetic Acid 12° Tw   |
| 200 "       | Tragacanth (60:1000) |
| 20 "        | Glycerine            |
| 10 "        | Oxalic Acid          |
| 20 "        | Alum                 |
| 120 "       | Water                |
| 1000 parts. |                      |

For Flavazine S, L and T.

#### Orange.

|          |                      |
|----------|----------------------|
| 20 parts | Orange No. 2         |
| 670 "    | Water                |
| 60 "     | Acetic Acid 12° Tw   |
| 200 "    | Tragacanth (60:1000) |
| 20 "     | Glycerine            |
| 10 "     | Oxalic Acid          |
| 20 "     | Alum                 |

1000 parts.

For all brands of Orange and Brilliant Orange.

#### Pink I.

|          |                      |
|----------|----------------------|
| 10 parts | Rosazeine B extra    |
| 695 "    | Water                |
| 60 "     | Acetic Acid 12° Tw   |
| 200 "    | Tragacanth (60:1000) |
| 20 "     | Glycerine            |
| 3 "      | Oxalic Acid          |
| 6 "      | Bichloride of Tin    |
| 6 "      | Oxalate of Ammonia   |

1000 parts.

For all brands of Rosazeine, Fast Acid Eosine, Fast Acid Phloxine, Acid Rosamine, Fast Acid Violet.

## Pink II.

|             |                        |
|-------------|------------------------|
| 10 parts    | Eosine                 |
| 200         | „ Water                |
| 200         | „ Tragacanth (60:1000) |
| 40          | „ Phosphate of Soda    |
| 430         | „ Water                |
| 20          | „ Tin salt Ia crystals |
| 100         | „ Water                |
| <hr/>       |                        |
| 1000 parts. |                        |

For all brands of Erythrosine, Phloxine, Rose Bengale, Rosa-zeine.

## Red.

|             |                        |
|-------------|------------------------|
| 20 parts    | Scarlet 5 R            |
| 670         | „ Water                |
| 60          | „ Acetic Acid 12° Tw   |
| 200         | „ Tragacanth (60:1000) |
| 20          | „ Glycerine            |
| 10          | „ Oxalic Acid          |
| 20          | „ Alum                 |
| <hr/>       |                        |
| 1000 parts. |                        |

For all brands of Scarlet and Victoria Scarlet.

## Green.

|             |                        |
|-------------|------------------------|
| 20 parts    | Acid Green conc. D     |
| 690         | „ Water                |
| 60          | „ Acetic Acid 12° Tw   |
| 10          | „ Oxalic Acid          |
| 200         | „ Tragacanth (60:1000) |
| 20          | „ Glycerine            |
| <hr/>       |                        |
| 1000 parts. |                        |

For all brands of Acid Green.

## Blue I.

|             |                        |
|-------------|------------------------|
| 10 parts    | Patent Blue V pat.     |
| 695         | „ Water                |
| 60          | „ Acetic Acid 12° Tw   |
| 200         | „ Tragacanth (60:1000) |
| 20          | „ Glycerine            |
| 5           | „ Oxalic Acid          |
| 10          | „ Alum                 |
| <hr/>       |                        |
| 1000 parts. |                        |

For all brands of Patent Blue, Cyanine B, Naphthalene Blue B, Indigo Substitute, Alkaline Blue, Opal Blue, Full Blue, Cotton Blue, Pure Blue.

## Blue II.

|             |                           |
|-------------|---------------------------|
| 20 parts    | Victoria Blue B           |
| 440         | „ Water                   |
| 60          | „ Acetic Acid 12° Tw      |
| 200         | „ Tragacanth (60:1000)    |
| 20          | „ Oxalic Acid             |
| 40          | „ Oxalate of Ammonia      |
| 20          | „ Chloride of Tin, solid, |
| 200         | „ Water                   |
| <hr/>       |                           |
| 1000 parts. |                           |

## Blue III.

|             |                        |
|-------------|------------------------|
| 40 parts    | Induline 2 N           |
| 700         | „ Water                |
| 200         | „ Tragacanth (60:1000) |
| 40          | „ Ammonia              |
| 20          | „ Glycerine            |
| <hr/>       |                        |
| 1000 parts. |                        |

## Violet I.

|             |                        |
|-------------|------------------------|
| 30 parts    | Acid Violet N          |
| 560         | „ Water                |
| 60          | „ Acetic Acid 12° Tw   |
| 200         | „ Tragacanth (60:1000) |
| 30          | „ Oxalic Acid          |
| 20          | „ Glycerine            |
| 100         | „ Water                |
| <hr/>       |                        |
| 1000 parts. |                        |

For all brands of Acid Violet, Fast Acid Violet and Fast Acid Blue.

## Violet II.

|             |                        |
|-------------|------------------------|
| 30 parts    | Victoria Violet 4 BS   |
| 670         | „ Water                |
| 200         | „ Tragacanth (60:1000) |
| 20          | „ Glycerine            |
| 50          | „ Ammonia              |
| 30          | „ Oxalate of Ammonia   |
| <hr/>       |                        |
| 1000 parts. |                        |

For Victoria Violet 4 BS, 8 BS, pat., Azo Acid Blue B pat.

## Brown.

|             |                        |
|-------------|------------------------|
| 15 parts    | Acid Violet N          |
| 15          | „ Orange No. 2         |
| 670         | „ Water                |
| 60          | „ Acetic Acid 12° Tw   |
| 200         | „ Tragacanth (60:1000) |
| 20          | „ Oxalic Acid          |
| 20          | „ Glycerine            |
| <hr/>       |                        |
| 1000 parts. |                        |

## Black I.

|             |                      |
|-------------|----------------------|
| 50 parts    | Azo Acid Black TL    |
| 620 "       | Water                |
| 200 "       | Tragacanth (60:1000) |
| 30 "        | Glycerine            |
| 50 "        | Ammonia              |
| 50 "        | Oxalate of Ammonia   |
| <hr/>       |                      |
| 1000 parts. |                      |

For all brands of Azo Acid Black pat.

## Black II.

|             |                        |
|-------------|------------------------|
| 40 parts    | Vigoureux Black I pat. |
| 593 "       | Water                  |
| 50 "        | Acetic Acid 12° Tw     |
| 200 "       | Tragacanth (60:1000)   |
| 32 "        | Sulphuric Acid 1:1     |
| { 40 "      | Fluoride of Chrome     |
|             | Water                  |
| 5 "         | Chlorate of Soda       |
| <hr/>       |                        |
| 1000 parts. |                        |

## Alizarine Yellow.

|             |                      |
|-------------|----------------------|
| 20 parts    | Alizarine Yellow     |
|             | GGW powder, pat.     |
| 530 "       | Water                |
| 50 "        | Acetic Acid 12° Tw   |
| 200 "       | Tragacanth (60:1000) |
| 10 "        | Sulphuric Acid       |
|             | 168' 2° Tw           |
| 20 "        | Fluoride of Chrome   |
| 150 "       | Water                |
| 20 "        | Glycerine            |
| <hr/>       |                      |
| 1000 parts. |                      |

## Alizarine Brown.

|             |                       |
|-------------|-----------------------|
| 150 parts   | Alizarine Brown paste |
| 480 "       | Water                 |
| 50 "        | Acetic Acid 12° Tw    |
| 200 "       | Tragacanth (60:1000)  |
| 40 "        | Fluoride of Chrome    |
| 150 "       | Water                 |
| 10 "        | Sulphuric Acid        |
|             | 168' 1/2° Tw          |
| 20 "        | Glycerine             |
| <hr/>       |                       |
| 1100 parts. |                       |

## Alizarine Red.

|             |                      |
|-------------|----------------------|
| 25 parts    | Alizarine Red 1WS    |
| 495 "       | Boiling Water        |
| 200 "       | Tragacanth (60:1000) |
| 40 "        | Sulphate of Alumina  |
| 20 "        | Oxalic Acid          |
| 200 "       | Water                |
| 20 "        | Glycerine            |
| <hr/>       |                      |
| 1000 parts. |                      |

## Alizarine Blue I.

|             |                      |
|-------------|----------------------|
| 66 parts    | Alizarine Blue SB    |
|             | powder               |
| 534 "       | Water                |
| 200 "       | Tragacanth (60:1000) |
| 10 "        | Tartaric Acid        |
| 150 "       | Water                |
| 20 "        | Fluoride of Chrome   |
| 20 "        | Glycerine            |
| <hr/>       |                      |
| 1000 parts. |                      |

For all "S" brands of Alizarine Blue in powder.

## Alizarine Blue II.

|             |                           |
|-------------|---------------------------|
| 100 parts   | Alizarine Blue S2R double |
| 500 "       | Water                     |
| 200 "       | Tragacanth (60:1000)      |
| 10 "        | Tartaric Acid             |
| 150 "       | Water                     |
| 20 "        | Fluoride of Chrome        |
| 20 "        | Glycerine                 |
| <hr/>       |                           |
| 1000 parts. |                           |

For all "S" brands of Alizarine Blue in paste.

### 3. Printing of slubbing

(Vigoureux printing).

The preparing and the application of printing Colours and also the process of steaming remains almost exactly the same as for pieces. The Chlorinating and preparing operations are, however, in most cases dispensed with, since they impair the wool fibre of the slubbing material. According to the employment of the printed slubbing for different goods more mordant colours are used for slubbing prints than for ordinary piece goods. The best Chrome Mordant for fixing the Mordant Colours is Fluoride of Chrome. Before adding it to the printing colour (contained in a wooden vessel!) it is made into a paste with one quarter of its weight of cold water.

The addition of Tournant Olive Oil or Castor Oil to the printing colours enhances the consistency of the pastes and also the handle of the printed sliver. Colours, which are sensitive to copper f. i. the Vigoureux-colours require the addition of some Sulphocyanide of Ammonia. Since the Mordant Colours are fixed with difficulty on unprepared slubbing, the steaming operation has to be considerably lengthened:

The printed, moist slubbing is steamed for 1 h with powerful steam but without pressure, then cooled down for 1 h and finally steamed again for 1 h.

The steamed material remains lying over night, during which time the colours are "set" and darkened, and is then passed through the gill box in the usual manner.

The colours suitable for slubbing printing are classified as follows.

#### a) Suitable for men's goods:

Alizarine Red 1WS, Alizarine Brown, Alizarine Orange, Ceruleine S brands, Alizarine Blue, Alizarine Green S, Alizarine Yellow GG pat., N, Mordant Yellow O, Acid Alizarine Blue BB, GR pat., Acid Alizarine Green G pat., Vigoureux Black I pat., Vigoureux Grey I pat., Vigoureux Brown I, Vigoureux Yellow I, Vigoureux Red I.

For shading purposes the following dyes may be recommended:

Fast Acid Blue B pat. ( $1\frac{1}{2}$ –2%), Acid Rosamine A pat. (up to  $1\frac{1}{2}$ %), Fast Acid Violet A2R, R, B, pat., Keton Blue 4BN pat., Patent Blue A pat., Acid Violet 5BF (up to  $\frac{1}{2}$ %).

#### b) Suitable for ladies' cloths:

Fast Acid Violet, Fast Acid Blue, Acid Rosamine, Keton Blue, Patent Blue A, Naphthalene Green, Naphthalene Blue, Indigo Substitute, Acid Violet 5BF, N, Victoria Violet, Azo Acid Blue, Chromotrope 2R, 2B, 6B, 8B, 10B with Fluoride of Chrome, Scarlet. Victoria Scarlet, Victoria Rubine, Amaranth, Naphthol Red, Fast Blue, Induline 2N, Orange, Victoria Yellow, Chinoline Yellow, Flavazine, Rosazeine, Fast Acid Eosine, Fast Acid Phloxine, Fast Acid Magenta.



## Scarlet.

|       |        |                                   |
|-------|--------|-----------------------------------|
| 30    | parts  | Colouring Matter,                 |
| 380   | „      | Hot Water                         |
| 500   | „      | British Gum Thickening (page 212) |
| 70    | „      | Acetic Acid 9° Tw                 |
| 20    | „      | Oxalic Acid                       |
| <hr/> |        |                                   |
| 1000  | parts. |                                   |

For Orange, Scarlet, Scarlet B extra, Victoria Rubine etc.

## Mordant Yellow.

|       |        |                                   |
|-------|--------|-----------------------------------|
| 40    | parts  | Mordant Yellow O are dissolved in |
| 620   | „      | Hot Water, and thickened with     |
| 200   | „      | British Gum powder.               |
|       |        | After cooling down add            |
| 60    | „      | Acetic Acid 9° Tw                 |
| 40    | „      | Fluoride of Chrome                |
| 40    | „      | Oxalic Acid                       |
| <hr/> |        |                                   |
| 1000  | parts. |                                   |

## Alizarine Orange.

|       |        |                                                                                                       |
|-------|--------|-------------------------------------------------------------------------------------------------------|
| 200   | parts  | Alizarine Orange N paste                                                                              |
| 60    | „      | Acetic Acid 9° Tw                                                                                     |
| 400   | „      | British Gum Thickening (page 212), are<br>made into a paste and the following in-<br>gredients added: |
| 60    | „      | Pyroligneite of Iron 23° Tw                                                                           |
| 30    | „      | Acetate of Lime 23° Tw                                                                                |
| 20    | „      | Fluoride of Chrome                                                                                    |
| 210   | „      | Water                                                                                                 |
| 20    | „      | Oxalic Acid                                                                                           |
| <hr/> |        |                                                                                                       |
| 1000  | parts. |                                                                                                       |

Alizarine Red 1WS  
(upon Alumina).

|       |        |                                                |
|-------|--------|------------------------------------------------|
| 50    | parts  | Alizarine Red 1WS                              |
| 550   | „      | Hot Water                                      |
| 200   | „      | British Gum powder. After cooling down<br>add: |
| 60    | „      | Acetic Acid 9° Tw                              |
| 120   | „      | Nitro-Acetate of Alumina 18° Tw                |
| 20    | „      | Oxalic Acid                                    |
| <hr/> |        |                                                |
| 1000  | parts. |                                                |

Alizarine Red 1WS  
(upon Chrome).

|       |        |                                              |
|-------|--------|----------------------------------------------|
| 50    | parts  | Alizarine Red 1WS                            |
| 640   | „      | Water                                        |
| 200   | „      | British Gum powder. When cooled down<br>add: |
| 60    | „      | Acetic Acid 9° Tw                            |
| 30    | „      | Fluoride of Chrome                           |
| 20    | „      | Oxalic Acid                                  |
| <hr/> |        |                                              |
| 1000  | parts. |                                              |

|      |                  |                                                               |
|------|------------------|---------------------------------------------------------------|
|      | Alizarine Brown. |                                                               |
| 200  | parts            | Alizarine Brown paste                                         |
| 60   | „                | Acetic Acid 9° Tw                                             |
| 100  | „                | British Gum Thickening (as below). Make into a paste and add: |
| 50   | „                | Fluoride of Chrome                                            |
| 260  | „                | Water                                                         |
| 30   | „                | Oxalic Acid                                                   |
| 1000 | parts.           |                                                               |

|      |                 |                                         |
|------|-----------------|-----------------------------------------|
|      | Alizarine Blue. |                                         |
| 50   | parts           | Alizarine Blue SB powder                |
| 350  | „               | Water                                   |
| 500  | „               | Dark burnt Starch 2:1                   |
| 20   | „               | Oxalic Acid                             |
| 80   | „               | Acetate of Chrome 32 $\frac{1}{2}$ ° Tw |
| 1000 | parts.          |                                         |

|      |                         |                             |
|------|-------------------------|-----------------------------|
|      | Alizarine Blue, shaded. |                             |
| 15   | parts                   | Patent Blue A pat.          |
| 475  | „                       | Boiling Water               |
| 250  | „                       | British Gum. Add when cold: |
| 150  | „                       | Alizarine Blue S2R paste    |
| 60   | „                       | Fluoride of Chrome          |
| 15   | „                       | Water                       |
| 15   | „                       | Tartaric Acid               |
| 20   | „                       | Tournant Oil                |
| 1000 | parts.                  |                             |

|      |            |                                                    |
|------|------------|----------------------------------------------------|
|      | Ceruleine. |                                                    |
| 400  | parts      | Ceruleine B paste                                  |
| 120  | „          | Water                                              |
| 400  | „          | British Gum Thickening. Make into a paste and add: |
| 50   | „          | Oxalic Acid                                        |
| 30   | „          | Fluoride of Chrome                                 |
| 1000 | parts.     |                                                    |

|      |                    |                                                                                   |
|------|--------------------|-----------------------------------------------------------------------------------|
|      | Vigoureux Colours. |                                                                                   |
| 50   | parts              | Colouring Matter                                                                  |
| 522  | „                  | Hot Water                                                                         |
| 250  | „                  | British Gum                                                                       |
| 50   | „                  | Acetic Acid 12° Tw. Add when cold:                                                |
| 40   | „                  | diluted Sulphuric Acid (500 parts of 168 $\frac{1}{2}$ ° Tw per 1000 parts water) |
| 50   | „                  | Fluoride of Chrome                                                                |
| 12,5 | „                  | Water                                                                             |
| 5    | „                  | Sodium Chlorate                                                                   |
| 20   | „                  | Tournant Oil                                                                      |
| 0,5  | „                  | Sulphocyanide of Ammonia                                                          |
| 1000 | parts.             |                                                                                   |

For all Vigoureux Colours.

|    |                         |                                       |
|----|-------------------------|---------------------------------------|
|    | British Gum Thickening. |                                       |
| 6  | parts                   | British Gum powder are well boiled in |
| 10 | „                       | Water and cooled.                     |

#### 4. Table showing the dischargeable qualities of colours on wool and silk.

1. Colours discharged to a pure white, even in dark shades.
2. Colours discharged white in light shades.
3. Colours, not discharged white, but suitable for bright coloured discharges.
4. Colours, not discharged white, suitable only for dark coloured discharges.
5. Colours, not discharged at all, and therefore suitable for additions to coloured discharge pastes.

| Colouring Matter     | Tin Discharge | Zinc Discharge | Observations | Colouring Matter     | Tin Discharge | Zinc Discharge | Observations |
|----------------------|---------------|----------------|--------------|----------------------|---------------|----------------|--------------|
| Auramine             | 5             | 2              |              | Methyl Violet        | 5             | 4-5            |              |
| Phosphine            | 4             | 4              |              | Violet crystals O    | 5             | 4-5            |              |
| Azo Phosphine        | 4             | 3-4            |              | Victoria Blue        | 5             | 3-4            |              |
| Chrysoidine          | 3-4           | 2-3            |              | Malachite Green      | 5             | 4-5            |              |
| Vesuvine             | 3-4           | 3              |              | Brilliant Green      | 5             | 4-5            |              |
| Cutch Brown          | 3-4           | 3              |              | Methylene Blue       | 4-5           | 4-5            |              |
| Dark Brown           | 3-4           | 3              |              | Marine Blue          | 4-5           | 4-5            |              |
| Magenta              | 4-5           | 4-5            |              | Methylene Green      | 4-5           | 4              |              |
| Cerise               | 4-5           | 4-5            |              | New Fast Blue        | 5             | 4-5            |              |
| Grenadine            | 4-5           | 4-5            |              | Fast Blue for Cotton | 5             | 4-5            |              |
| Maroon               | 4-5           | 4-5            |              | Methylene Grey       | 4-5           | 4              |              |
| New Magenta          | 4-5           | 4-5            |              | Eosine               | 4-5           | 4              |              |
| Safranine            | 5             | 5              |              | Erythrosine          | 4-5           | 4              |              |
| Methylene Violet     | 5             | 5              |              |                      |               |                |              |
| Methylene Heliotrope | 5             | 4              |              |                      |               |                |              |

| Colouring Matter   | Tin Discharge | Zinc Discharge | Observations       | Colouring Matter       | Tin Discharge | Zinc Discharge | Observations |
|--------------------|---------------|----------------|--------------------|------------------------|---------------|----------------|--------------|
| Phloxine           | 4-5           | 4              | * Violet Discharge | Blue red shade         | 5             | 1-2            |              |
| Rose Bengale       | 4-5           | 4              |                    | Conc. Cotton Blue      | 5             | 1-2            |              |
| Rosazeine          | 4-5           | 4              |                    | Pure Blue              | 5             | 1-2            |              |
| Rosazeine 4G       | 4-5           | 4-5            |                    | Cotton Light Blue      | 5             | 1-2            |              |
| Fast Acid Eosine   | 5             | 3-4            |                    | Methyl Blue for Cotton | 5             | 1-2            |              |
| Fast Acid Phloxine | 5             | 3-4            |                    | Acid Green             | 4-5           | 1              |              |
| Fast Acid Red      | 4*            | 3              |                    | Nachthalene Green      | 4-5           | 1              |              |
| Fast Acid Violet   | 5             | 4              |                    | Naphthalene Blue       | 4-5           | 1-2            |              |
| Fast Acid Blue     | 5             | 4              |                    | Patent Blue            | 4-5           | 1              |              |
| Acid Magenta       | 4-5           | 1-2            |                    | Cyanine                | 4-5           | 1              |              |
| Acid Cerise        | 4-5           | 3              |                    | Keton Blue             | 4-5           | 1              |              |
| Acid Maroon        | 4-5           | 3              |                    | Fast Blue              | 4-5           | 3-4            |              |
| Alkaline Violet    | 4-5           | 1-2            |                    | Induline 2N            | 4-5           | 3-4            |              |
| Alkaline Blue      | 4-5           | 1-2            |                    | Chinoline Yellow       | 5             | 4-5            |              |
| Methyl Alk. Blue   | 4-5           | 1-2            |                    | Naphthol Yellow        | 3-4           | 3-4            |              |
| Guernsey Blue      | 5             | 1-2            |                    | Flavazine              | 1-2           | 1-2            |              |
| Bleu de Lyon       | 5             | 1-2            |                    | Azo Yellow             | 1-2           | 2-3            |              |
| Purple Blue        | 5             | 1-2            |                    | Victoria Yellow        | 2-3           | 1-2            |              |
| Full Blue          | 5             | 1-2            |                    | Metanil Yellow         | 1-2           | 1              |              |
| Opal Blue          | 5             | 1-2            |                    |                        |               |                |              |
| Blue blue shade    | 5             | 1-2            |                    |                        |               |                |              |

| Colouring Matter      | Tin Discharge | Zinc Discharge | Observations | Colouring Matter                    | Tin Discharge | Zinc Discharge | Observations       |
|-----------------------|---------------|----------------|--------------|-------------------------------------|---------------|----------------|--------------------|
| Orange                | 1-2           | 1              |              | Azo Acid Magenta                    | 4*            | 3-4            | * Violet Discharge |
| Brilliant Orange      | 1-2           | 1              |              | Amido Naphthol Red                  | 1             | 2-3            |                    |
| Scarlet G             | 2             | 1-2            |              | Victoria Violet                     | 2-3           | 1-2            |                    |
| Scarlet 6 R           | 2-3           | 1              |              | Azo Acid Blue                       | 2-3           | 1-2            |                    |
| Scarlet B extra       | 2-3           | 1-2            |              | Azo Acid Black B, R, G              | 3             | 3              |                    |
| Scarlet crystals      | 2-3           | 1-2            |              | Azo Acid Black L brands             | 3             | 3-4            |                    |
| New Coccine           | 2-3           | 1-2            |              | Amido Naphthol Black                | 2-3           | 3              |                    |
| Victoria Scarlet 3G-G | 2-3           | 1-2            |              | Chromotrope                         | 2-3           | 2              |                    |
| Victoria Scarlet R-6R | 2-3           | 1              |              | Alizarine Yellow GG paste           | 3             | 2-3            |                    |
| Brilliant Croceine    | 2-3           | 1-2            |              | Alizarine Yellow R paste            | 3             | 3              |                    |
| Fast Red              | 2             | 1-2            |              | Alizarine Orange (Alumina Mor-dant) | 4*            | 4*             | * Brown Discharge  |
| Naphthol Red          | 2             | 1              |              | Alizarine Orange (Chrome Mor-dant)  | 5*            | 5*             | * do.              |
| Brilliant Crimson     | 2             | 1-2            |              | Alizarine Red (Alumina Mor-dant)    | 4-5*          | 5*             | * Yellow Discharge |
| Amaranth              | 2             | 1              |              | Alizarine Red (Chrome Mor-dant)     | 4-5*          | 5*             | * do.              |
| Victoria Rubine       | 2             | 1              |              |                                     |               |                |                    |
| Cloth Red             | 2             | 1-2            |              |                                     |               |                |                    |
| Claret Red            | 2-3           | 1              |              |                                     |               |                |                    |
| Archil Substitute     | 2             | 1-2            |              |                                     |               |                |                    |
| Alkali Fast Red       | 2             | 2-3            |              |                                     |               |                |                    |

| Colouring Matter                              | Tin Discharge | Zinc Discharge | Observations | Colouring Matter       | Tin Discharge | Zinc Discharge | Observations |
|-----------------------------------------------|---------------|----------------|--------------|------------------------|---------------|----------------|--------------|
| <b>Alizarine Claret</b><br>(Alumina Mor-dant) | 5             | 5              |              | <b>Alizarine Brown</b> | 5             | 5              |              |
| <b>Alizarine Claret</b><br>(Chrome Mor-dant)  | 5             | 5              |              | <b>Alizarine Blue</b>  | 5             | 5              |              |
|                                               |               |                |              | <b>Alizarine Green</b> | 5             | 5              |              |
|                                               |               |                |              | <b>Ceruleine</b>       | 5             | 5              |              |

## X. SILK PRINTING.

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The Silk fibre resembles wool to such an extent as regards its affinity to most dyestuffs, that the printing of silk varies little from the printing of wool. Since the affinity of silk to the dyestuffs is rather greater, however, than that of wool, the preparation with Chlorine can be dispensed with.

Of those colours which are produced direct upon the fibre Nitroso Blue, Aniline Black, Solid Green Brown are likewise suitable for silk. These colours are obtained on silk as described for Half silk material under Z. The insoluble Azo Colours are not suitable for silk on account of rubbing.

All colours applied to silk must be fast to water.

### a) Direct print.

The silk (in its natural state or weighted with Tin preparations) is printed as woven fabric or in the yarn. The following preparation produces good results as regards equalising and depth of shade.

#### Tin preparation.

The wet silk material is passed through Chloride of Tin 7.2° Tw on the padding machine, and remains lying rolled up for 1—2 h. It is then passed through a bath containing 50 parts Phosphate of Soda per 1000 liquid and after lying again for 1—2 h. is well washed and dried.

Colours suitable for direct prints on silk:

Basic Colours (page 189) with or without Tannin.

Mordant Colours (page 192), some of these (Aliz Yellow GG and R) may be applied without a mordant.

Resorcline Colours (page 190).

Acid Colours (page 190).

Direct dyeing Colours (page 192).

Nitroso Colours (page 115).

Aniline Black and Solid Green-Brown (page 115).

Before producing Nitroso Blue shades on silk, the material must be well cleansed and the printing colours must be prepared with a considerable surplus of Oxalic Acid.

The following recipes produce good results:

|             |                      |
|-------------|----------------------|
| 20 parts    | Colouring Matter     |
| 360 "       | Water                |
| 100 "       | Acetic Acid 9° Tw    |
| 450 "       | Tragacanth (60:1000) |
| 20 "        | Glycerine            |
| 20 "        | Tartaric Acid        |
| 30-60 parts | Water                |

1000 parts.

For basic dyes fixed without tannin.

|          |                      |
|----------|----------------------|
| 20 parts | Colouring Matter     |
| 490 "    | Water                |
| 450 "    | Tragacanth (60:1000) |
| 20 "     | Tartaric Acid        |
| 20 "     | Glycerine            |

1000 parts.

For acid dyes.

|             |                             |
|-------------|-----------------------------|
| 20 parts    | Colouring Matter            |
| 360 "       | Water                       |
| 100 "       | Acetic Acid 9° Tw           |
| 450 "       | Tragacanth (60:1000)        |
| 20 "        | Glycerine                   |
| 20 "        | Tartaric Acid               |
| 30-60 parts | Acetic Acid Tannin sol. 1:1 |

1000 parts.

For basic dyes fixed with tannin.

|          |                   |
|----------|-------------------|
| 20 parts | Colouring Matter  |
| 620 "    | Water             |
| 300 "    | British Gum       |
| 60 "     | Acetic Acid 9° Tw |

1000 parts.

For direct dyes.

## b) Discharge prints.

The silk material is dyed with dischargeable colours and then discharged with Tin salt or Zinc dust printing colours.

Tin salt discharges are liable to injure the fibre and are therefore less often used than Zinc dust discharges.

### 1. Tin salt Discharges.

The following colours are easily discharged with Tin Discharges.

a) Ground colours for white effects:

**Victoria Yellow, Metanil Yellow, Orange No. 4, Nr. 2, G, Scarlet** (particularly the blue brands), and those Dianil Colours which are also well dischargeable on cotton, see page 159.

b) Ground colours for coloured effects.

**Naphthol Yellow, Azo Yellow, Victoria Yellow, Metanil Yellow, Orange No. 4, No. 2, G, Brilliant Orange, Scarlet, Victoria Scarlet, Scarlet crystals, New Coccine, Brilliant Croceine, Amaranth, Fast Red, Brilliant Crimson, Victoria Rubine, Naphthol Red, Cloth Red, Claret Red, Chromotrope, Azo Acid Blue, Victoria Violet, Azo Acid Black,** and the Dianil dyes mentioned on page 159 under b).

Coloured Tin Discharges are obtained with:

**Auramine, Magenta, Cerise, Grenadine, Maroon, Phosphine, Methyl Violet, Brilliant Green, Malachite Green, Methyl Alkaline Blue, Alkaline Blue, Opal Blue, Full Blue, Purple Blue, Bleu de Lyon, Cotton Blue, Guernsey Blue, Acid Violet, Patent Blue, Cyanine, Naphthalene Blue, Naphthalene Green, Victoria Blue, Chinoline Yellow.**



## White Discharge.

|             |                          |
|-------------|--------------------------|
| 450 parts   | Acid Starch (page 126)   |
| 120 "       | Tragacanth (60:1000)     |
| 125 "       | Tin salt Ia cryst.       |
| 230 "       | Water.                   |
| 50 "        | Sulphocyanide of Ammonia |
| 25 "        | Citric Acid 36° Tw.      |
| <hr/>       |                          |
| 1000 parts. |                          |

## Yellow Discharge.

|             |                          |
|-------------|--------------------------|
| 30 parts    | Auramine conc. pat.      |
| 140 "       | Water                    |
| 700 "       | Gum Solution 1:1         |
| 90 "        | Tin salt Ia cryst.       |
| 25 "        | Sulphocyanide of Ammonia |
| 15 "        | Citric Acid              |
| <hr/>       |                          |
| 1000 parts. |                          |

## Red Discharge.

|             |                          |
|-------------|--------------------------|
| 30 parts    | Rosazeine extra          |
| 5 "         | Auramine conc. pat.      |
| 135 "       | Water                    |
| 700 "       | Gum Solution 1:1         |
| 90 "        | Tin salt Ia cryst.       |
| 25 "        | Sulphocyanide of Ammonia |
| 15 "        | Citric Acid              |
| <hr/>       |                          |
| 1000 parts. |                          |

## Blue Discharge I.

|             |                          |
|-------------|--------------------------|
| 30 parts    | Acid Violet N            |
| 10 "        | Patent Blue V pat.       |
| 110 "       | Water                    |
| 700 "       | Gum Solution 1:1         |
| 100 "       | Tin salt Ia cryst.       |
| 30 "        | Sulphocyanide of Ammonia |
| 20 "        | Citric Acid              |
| <hr/>       |                          |
| 1000 parts. |                          |

## Blue Discharge II.

|             |                             |
|-------------|-----------------------------|
| 30 parts    | Methyl Violet 2B            |
| 10 "        | Malachite Green cryst. ext. |
| 110 "       | Acetic Acid 5.8° Tw         |
| 700 "       | Gum Solution 1:1            |
| 100 "       | Tin salt Ia cryst.          |
| 30 "        | Sulphocyanide of Ammonia    |
| 20 "        | Citric Acid                 |
| <hr/>       |                             |
| 1000 parts. |                             |

## Green Discharge.

|          |                                |
|----------|--------------------------------|
| 15 parts | Auramine O pat.                |
| 15       | „ Brilliant Green cryst. extra |
| 70       | „ Acetic Acid 5.8° Tw          |
| 750      | „ Gum Solution 1:1             |
| 100      | „ Tin salt Ia cryst.           |
| 30       | „ Sulphocyanide of Ammonia     |
| 20       | „ Citric Acid                  |
| <hr/>    |                                |
| 1000     | parts.                         |

## 2. Zinc Dust Discharges.

The following colours are easily discharged with Zinc Dust Discharges.

## a) Ground Colours for white effects.

Victoria Yellow, Orange No. 4, No. 2, G, Brilliant Orange, Scarlet (blue shades), New Coccine, Victoria Scarlet (blue shades), Fast Red, Claret Red, Brilliant Crimson, Amaranth, Victoria Rubine, Naphthol Red, Methyl Alkaline Blue, Alkaline Blue, Opal Blue, Bleu de Lyon, Full Blue, Purple Blue, Guernsey Blue, Blue for Silk, Blue blueish, Blue red shade, Acid Magenta, Acid Green, Naphthalene Blue, Naphthalene Green, Patent Blue, Cyanine, Keton Blue, Flavazine S, L.

## b) Ground Colours for coloured effects:

The dyes mentioned under a) and: Naphthol Yellow, Azo Yellow, Scarlet G, Scarlet crystals, Scarlet B extra, Victoria Scarlet (yellow shades), Chromotrop, Azo Acid Blue, Victoria Violet, Azo Acid Black B, R, G, Alkaline Violet, Acid Cerise.

Coloured Zinc Dust Discharges are obtained with:

Chinoline Yellow, Safranine, Methylene Violet, Methylene Blue.

## Discharge White I.

|           |                                            |
|-----------|--------------------------------------------|
| 300 parts | Zinc Dust                                  |
| 500       | „ Gum Solution                             |
| 50        | „ Glycerine                                |
| 50        | „ Ammonia                                  |
| 100       | „ Bisulphite of Soda 66 $\frac{1}{2}$ ° Tw |
| <hr/>     |                                            |
| 1000      | parts.                                     |

## Discharge White II.

|           |                                                           |
|-----------|-----------------------------------------------------------|
| 250 parts | Zinc Dust, finely powdered, are ground with               |
| 200       | „ Gum Solution 1:1. Whilst cooling                        |
| 400       | „ Bisulphite of Soda 66 $\frac{1}{2}$ ° Tw are added, and |
|           | when the reaction has taken place:                        |
| 70        | „ Formaldehyde 40%                                        |
| 50        | „ Glycerine                                               |
| <hr/>     |                                                           |

## Coloured Zinc Dust Discharge.

|   |            |                        |
|---|------------|------------------------|
|   | 500 parts  | Standard White         |
| { | 300        | „ Gum Solution         |
|   | 20—40      | parts Colouring matter |
|   | <u>200</u> | parts Water            |

## Standard White.

|   |             |                                                      |
|---|-------------|------------------------------------------------------|
| { | 200 parts   | Gum Solution 1:1 and                                 |
|   | 600         | „ Zinc Dust are finely ground, and whilst cooling    |
|   | 200         | „ Bisulphite of Soda 66 $\frac{1}{2}$ ° Tw are added |
|   | <u>1000</u> | parts.                                               |

## c) Resist prints.

For Resist styles Tin salt or Zinc dust Resists also Resin and Fat Resists are employed.

The Tin salt and Zinc dust Resists are printed upon the silk material and the latter then overprinted with thickened colour solutions. The colours suitable for this purpose are given under Nos. 1 and 2 on pages 218—220.

Resin and Fat Resists are frequently applied to silk fabrics. The latter are printed with the resist colours, dried, and then dyed in a cold bath. Finally the fat or resin is removed by passing the goods through a Benzene bath.

## Zinc dust Resist.

|             |                           |
|-------------|---------------------------|
| 540 parts   | Gum sol. 1:1              |
| 360         | „ Zinc dust finely ground |
| 100         | „ China Clay              |
| <u>1000</u> | parts.                    |

## Resin Resist.

|             |              |
|-------------|--------------|
| 650 parts   | Colophony    |
| 50          | „ Yellow wax |
| 300         | „ Benzol     |
| <u>1000</u> | parts.       |

## Y. HALF WOOL PRINTING.

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For printing half wool material the latter must be suitably prepared like wool fabrics and the colours properly selected and combined.

### a) Preparing.

I. Cleansing and bleaching. The pieces must be well cleansed at  $113^{\circ}$  F. in a bath containing 4 parts soap and 6 parts Soda (Ammonia process); then washed and finally passed through a soda solution of  $\frac{3}{4}^{\circ}$  Tw in order to remove all remnants of soap. They are then stoved with Sulphurous Acid, either by a continuous process or over night soured with diluted Sulphuric Acid (1:1000) and washed until all the Acid is removed (Congo Red reaction).

II. Chlorinating. The pieces pass at full width through a Chlorine bath, which is prepared with a solution of 26 parts Chloride of lime  $9^{\circ}$  Tw in 200 parts Water, and 15 parts Muriatic Acid  $38^{\circ}$  Tw in 200 parts Water. They are then washed until a solution of Congo Red shows that no trace of Acid is left in them.

### III. Mordanting:

1st bath: The pieces are passed through a cold solution of Perchloride of Tin  $4.5^{\circ}$  Tw on the padding machine and remain rolled up for 2 h; they are then passed into the

2nd bath in a roller cistern: which contains 50 parts of Sodium Phosphate per 1000 parts. After washing and hydroextracting they are dried.

Basic, direct dyeing and acid colours are mostly used for printing; mordant colours are seldom employed. If the latter are employed they are used in connection with basic dyestuffs to ensure a better covering of the cotton fibre. Direct dyeing Colours are very suitable for padding together with Phosphate of Soda. The pieces are padded in the hot flue with the colour solutions and then overprinted with printing or discharging colours.

After printing, the pieces are moistened, steamed for 1 h with dry steam without pressure and carefully washed.

The preparation with Phosphate of Tin makes the aftertreatment with Tartar Emetic dispensable for basic colours.

## b) Direct prints.

The following recipes are recommendable for direct prints.

|             |                                 |
|-------------|---------------------------------|
| 20 parts    | Colouring matter                |
| 80 „        | Alcohol or Acetic Acid 9° Tw    |
| 130 „       | Water                           |
| 700 „       | Gum Solution 1:1                |
| 10—20 parts | Tartaric Acid                   |
| 20—40 „     | Acetic Acid Tannin solution 1:1 |

For all basic dyestuffs.

|          |                                 |
|----------|---------------------------------|
| 20 parts | Conc. Cotton Blue R             |
| 140 „    | Acetic Acid 12° Tw              |
| 180 „    | Boiling water                   |
| 600 „    | Gum Solution 1:1                |
| 20 „     | Tartaric Acid                   |
| 40 „     | Acetic Acid Tannin Solution 1:1 |

For Alkaline Blue, Opal Blue, Full Blue, Pure Blue, Soluble Blue.

|             |                                 |
|-------------|---------------------------------|
| 12 parts    | Rosazeine extra                 |
| 6 „         | Auramine conc. pat.             |
| 75 „        | Alcohol                         |
| 142 „       | Water                           |
| 725 „       | Gum Solution 1:1                |
| 30 „        | Acetic Acid Tannin Solution 1:1 |
| 10 „        | Tartaric Acid                   |
| 20—40 parts | Colouring matter                |
| 380 „       | Water                           |
| 400 „       | Tragacanth (60:1000)            |
| 100 „       | Burnt Starch                    |
| 30 „        | Phosphate of Soda               |
| 60 „        | Water                           |

For all Dianil Colours.

Black.

|          |                                          |
|----------|------------------------------------------|
| 40 parts | Dianil Black G pat.                      |
| 20 „     | Dianil Black N pat.                      |
| 5 „      | Dianil Blue G pat.                       |
| 5 „      | Dianil Yellow 3G pat.                    |
| 20 „     | Phosphate of Soda                        |
| 700 „    | Water, dissolve at the boil and add hot: |
| { 80 „   | Wheat Starch                             |
| { 40 „   | Dextrine                                 |
| { 120 „  | Water                                    |

## c) Discharge prints.

Discharge effects upon half wool pieces are obtained on dyed or padded material.

The easiest way of producing even results is by padding the material with suitably prepared colour solutions. With the following recipes good padding liquids for half wool materials are obtained.

**Padding Liquids.****Yellow.**

|                 |       |                      |
|-----------------|-------|----------------------|
| 2 $\frac{1}{2}$ | parts | Dianil Yellow R pat. |
| 900             | „     | Water                |
| 50              | „     | Tragacanth (60:1000) |
| { 10            | „     | Phosphate of Soda    |
| { 50            | „     | Water.               |

**Pink.**

|      |       |                              |
|------|-------|------------------------------|
| { 1  | parts | Rosazeine 4 G pat.           |
| { 10 | „     | Acetic Acid 6° Tw            |
| 935  | „     | Water                        |
| 50   | „     | Tragacanth (60:1000)         |
| 5    | „     | Acetic Acid Tannin sol. 1:1. |

**Heliotrope.**

|                 |       |                              |
|-----------------|-------|------------------------------|
| 2 $\frac{1}{2}$ | parts | Methylene Heliotrope O       |
| 10              | „     | Acetic Acid 6° Tw            |
| 980             | „     | Water                        |
| 50              | „     | Tragacanth (60:1000)         |
| 10              | „     | Acetic Acid Tannin sol. 1:1. |

**Brown.**

|      |       |                      |
|------|-------|----------------------|
| 10   | parts | Dianil Brown 2 G     |
| 900  | „     | Water                |
| 50   | „     | Tragacanth (60:1000) |
| { 10 | „     | Phosphate of Soda    |
| { 50 | „     | Water.               |

**Light Blue.**

|      |       |                      |
|------|-------|----------------------|
| 1.8  | parts | Dianil Blue G pat.   |
| 0.75 | „     | Patent Blue B pat.   |
| 900  | „     | Water                |
| 50   | „     | Tragacanth (60:1000) |
| { 10 | „     | Phosphate of Soda    |
| { 50 | „     | Water.               |

**Medium Blue.**

|      |       |                      |
|------|-------|----------------------|
| 20   | parts | Dianil Blue G pat.   |
| 900  | „     | Water                |
| 50   | „     | Tragacanth (60:1000) |
| { 20 | „     | Phosphate of Soda    |
| { 50 | „     | Water.               |

Dark Blue.

|              |                      |
|--------------|----------------------|
| 50 parts     | Dianil Blue R pat.   |
| 800 "        | Water                |
| 50 "         | Tragacanth (60:1000) |
| 30 "         | Phosphate of Soda    |
| <u>150</u> " | Water                |

Green.

|               |                          |
|---------------|--------------------------|
| 1 part        | Dianil Blue G pat.       |
| 5 parts       | Dianil Yellow 3 G pat.   |
| 1.7 "         | Chinoline Yellow O       |
| 0.3 "         | Naphthalene Green V pat. |
| 940 "         | Water                    |
| 50 "          | Tragacanth (60:1000)     |
| f 10 "        | Phosphate of Soda        |
| <u>1 50</u> " | Water                    |

Discharge Colours.

Discharge White.

|                 |                          |
|-----------------|--------------------------|
| 200 parts       | Tragacanth (60:1000)     |
| 400 "           | Acid Starch (page 126)   |
| 180 "           | Sulphocyanide of Ammonia |
| 200-300 parts   | Tin Salt Ia cryst.       |
| <u>20 parts</u> | Citric Acid              |

Discharge Pink.

|             |                                 |
|-------------|---------------------------------|
| 80 parts    | Rosazeine 4 G pat.              |
| 5 "         | Rosazeine extra                 |
| 150 "       | Acetic Acid 6° Tw               |
| 500 "       | Gum Solution 1:1                |
| 50 "        | Sulphocyanide of Ammonia        |
| 160 "       | Tin salt Ia cryst.              |
| 10 "        | Citric Acid                     |
| <u>50</u> " | Acetic Acid Tannin Solution 1:1 |

Discharge Red.

|             |                                 |
|-------------|---------------------------------|
| { 75 parts  | Rosazeine 4 G pat.              |
| 6 "         | Safranine AN extra              |
| 150 "       | Acetic Acid 6° Tw               |
| 400 "       | Gum Solution 1:1                |
|             | Add cold:                       |
| 60 "        | Persian Berry Extract 76° Tw    |
| 50 "        | Sulphocyanide of Ammonia        |
| 200 "       | Tin Salt Ia cryst.              |
| <u>60</u> " | Acetic Acid Tannin Solution 1:1 |

## Discharge Yellow.

|     |       |                                 |
|-----|-------|---------------------------------|
| 30  | parts | Auramine conc. pat.             |
| 100 | "     | Water                           |
| 80  | "     | Acetic Acid 6° Tw               |
| 60  | "     | Sulphocyanide of Ammonia        |
| 400 | "     | Gum Solution 1:1                |
| 250 | "     | Tin Salt Ia cryst.              |
| 15  | "     | Citric Acid                     |
| 60  | "     | Acetic Acid Tannin Solution 1:1 |

## Discharge Darkblue.

|     |       |                                 |
|-----|-------|---------------------------------|
| 30  | parts | Violet crystals O               |
| 30  | "     | Victoria Blue B                 |
| 15  | "     | Brilliant Green cryst ext.      |
| 20  | "     | Persian Berry Extract 76° Tw    |
| 175 | "     | Acetic Acid 6° Tw               |
| 450 | "     | Gum Solution 1:1                |
| 70  | "     | Sulphocyanide of Ammonia        |
| 150 | "     | Tin Salt Ia cryst.              |
| 60  | "     | Acetic Acid Tannin Solution 1:1 |

## Discharge Green,

|     |       |                                 |
|-----|-------|---------------------------------|
| 20  | parts | Brilliant Green cryst. extr.    |
| 10  | "     | Auramine conc. pat.             |
| 154 | "     | Acetic Acid 6° Tw               |
| 400 | "     | Acid Starch (see p. 126)        |
| 16  | "     | Citric Acid                     |
| 80  | "     | Sulphocyanide of Ammonia        |
| 240 | "     | Tin Salt Ia cryst.              |
| 80  | "     | Acetic Acid Tannin Solution 1:1 |



## Z. HALF SILK PRINTING.

Fabrics containing cotton and silk are printed in a similar manner to ordinary cotton. Therefore all basic, mordant, and direct dyeing colours are suitable for this purpose. For shading off the silk, several Acid and Resorcine Colours are used.

On account of the cotton contained in the fabric, all Basic colours are prepared with Tannin, which enhances the fastness to washing.

The Resist and Discharge styles are the most important for half silk materials. The direct print is also used, and in that case carried out according to recipes given under Cotton and Silk printing.

The insoluble Azo colours, produced direct upon the fibre are not suitable for half silk fabrics, as they rub off too much. On the other hand good results are obtained with Solid Green-Brown as padded and resist styles according to the recipes given on pages 141 and 158.

Also Aniline Black is frequently used for Half silk printing.

### Aniline Oxidation Black.

|   |             |        |                                       |
|---|-------------|--------|---------------------------------------|
| { | 120         | parts  | Aniline Black                         |
| { | 230         | „      | Water                                 |
|   | 600         | „      | Thickening for Black, add before use: |
|   | 50          | „      | Sulphide of Copper paste 20%.         |
|   | <u>1000</u> | parts. |                                       |

### Thickening for Black.

|             |        |                             |
|-------------|--------|-----------------------------|
| 150         | parts  | Wheat Starch                |
| 100         | „      | Tragacanth (60:1000)        |
| 180         | „      | Burnt Starch                |
| 476         | „      | Water                       |
| 30          | „      | Tournant Oil                |
| 2           | „      | Magenta small cryst.        |
|             |        | Boil, and add when lukewarm |
| 60          | „      | Chlorate of Soda, add cold, |
| 2           | „      | Sulphocyanide of Potassium. |
| <u>1000</u> | parts. |                             |

After printing and drying the goods are oxidised in the Oxidation room at 86—90° F until the black is properly developed and then they are passed through a Bichrome bath (5—10 parts per 1000) at 140° F and finally washed and soaped.

Dark Navy Blues are produced on Half silk fabrics with Nitroso Blue MR.

For print effects, obtained with Nitroso Blue MR, the material must be well cleansed and the padding liquids are to be prepared with considerably more Acid than is required for cotton; this is necessary in order to obtain a pure blue.

The goods are prepared as follows :

The material is washed in a lukewarm solution of Soda (5 per 1000), well rinsed, soured in a lukewarm Acid bath (5 parts of Muriatic Acid conc. per 1000) washed again and dried. The passage through Acid is necessary for the production of a good blue.

The best White effects are produced as Resist prints. The white Resist colour is first printed, then the material padded on the padding machine and finally carefully dried.

In place of padding rollers a solid honey-combed roller may be used and the Nitroso Blue printed on the printing machine.

The goods are steamed with powerful steam but without pressure for 5 to 15 min., then passed through an Antimony bath; washed and soaped and finished off in the usual manner.

The padding liquids are prepared by mixing the Nitroso base with Water and Muriatic Acid and stirring into the yellow mixture the lukewarm solution of Tannoxyphenol or Resorcine together with the solution of Tannin until the whole is perfectly dissolved. Then the Tragacanth is mixed with a solution of Oxalic Acid, and this mixture added to the above solution and the whole made up to 1000 parts.

#### White Resist.

|           |                       |
|-----------|-----------------------|
| 170 parts | British Gum           |
| 195       | „ Water               |
| 130       | „ Glue solution 1:2   |
| 85        | „ Acetic Acid 12° Tw  |
| 250       | „ Tin Salt Ia, cryst. |
| 170       | „ Tartaric Acid       |
| 1000      | parts.                |

#### Thickening

(for reducing the White Resist).

|           |                      |
|-----------|----------------------|
| 350 parts | British Gum          |
| 400       | „ Water              |
| 170       | „ Glue solution 1:2  |
| 80        | „ Acetic Acid 12° Tw |
| 1000      | parts.               |

#### Padding Liquid.

|                            | 1.                     | 2.          |
|----------------------------|------------------------|-------------|
| { Nitroso Base M 50% paste | 50 parts               | 50 parts    |
| { Hydrochloric Acid 36° Tw | 16,7 „                 | 16,7 „      |
| { Water                    | 140 „                  | 170 „       |
| { Tannoxyphenol R pat.     | — „                    | 63 „        |
| { Resorcine                | 33 „                   | — „         |
| { Hot Water                | 85 „                   | 85 „        |
| Tannin solution (1:1)      | 100 „                  | — „         |
| Oxalic Acid sol. (1:10)    | 420 „                  | 420 „       |
| Tragacanth (60:1000)       | 100 „                  | 100 „       |
|                            | make up to 1000 parts. | 1000 parts. |

## Appendix.

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Tables and methods of analysis.

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# Table of the Elements, their symbols and Atomic weight.

Oxygen, O = 16.

|                  |    |        |                  |    |        |
|------------------|----|--------|------------------|----|--------|
| Aluminum . . .   | Al | 27,1   | Neodym . . .     | Nd | 143,6  |
| Antimony . . .   | Sb | 120    | Neonium . . .    | Ne | 29     |
| Argon . . .      | A  | 39,9   | Nickel . . .     | Ni | 58,7   |
| Arsenic . . .    | As | 75     | Niobium . . .    | Nb | 94     |
| Barium . . .     | Ba | 137,4  | Nitrogen . . .   | N  | 14,04  |
| Beryllium . . .  | Be | 9,1    | Osmium . . .     | Os | 191    |
| Bismuth . . .    | Bi | 208,5  | Oxygen . . .     | O  | 16,2   |
| Boron . . .      | B  | 11     | Palladium . . .  | Pd | 106    |
| Bromine . . .    | Br | 79,96  | Phosphorus . . . | P  | 31     |
| Cadmium . . .    | Cd | 112,4  | Platinum . . .   | Pt | 194,8  |
| Caesium . . .    | Cs | 133    | Potassium . . .  | K  | 39,15  |
| Calcium . . .    | Ca | 140    | Praseodym . . .  | Pr | 140,5  |
| Carbon . . .     | C  | 12     | Rhodium . . .    | Rh | 103    |
| Cerium . . .     | Ce | 140    | Rubidium . . .   | Rb | 85,4   |
| Chlorine . . .   | Cl | 35,5   | Ruthenium . . .  | Ru | 101,7  |
| Chromium . . .   | Cr | 52,1   | Samarium . . .   | Sa | 150    |
| Cobalt . . .     | Co | 59     | Scandium . . .   | Sc | 44,1   |
| Copper . . .     | Cu | 63,6   | Selenium . . .   | Se | 79,1   |
| Erbium . . .     | Er | 166    | Silicium . . .   | Si | 28,4   |
| Fluorine . . .   | F  | 19     | Silver . . .     | Ag | 107,93 |
| Gadolinium . . . | Gd | 156    | Sodium . . .     | Na | 23,05  |
| Gallium . . .    | Ga | 70     | Strontium . . .  | Sr | 87,6   |
| Germanium . . .  | Ge | 72     | Sulphur . . .    | S  | 32,06  |
| Gold . . .       | Au | 197,2  | Tantalum . . .   | Ta | 183    |
| Helium . . .     | He | 4      | Tellurium . . .  | Te | 127    |
| Hydrogen . . .   | H  | 1,01   | Thallium . . .   | Tl | 204,1  |
| Indium . . .     | In | 114    | Tin . . .        | Sn | 118,5  |
| Iridium . . .    | Ir | 193    | Titanium . . .   | Ti | 48     |
| Iodine . . .     | I  | 126,85 | Thorium . . .    | Th | 232,5  |
| Iron . . .       | Fe | 56     | Thulium . . .    | Tu | 171    |
| Krypton . . .    | Kr | 81,8   | Tungsten . . .   | W  | 184    |
| Lanthanum . . .  | La | 138    | Uranium . . .    | U  | 239,5  |
| Lead . . .       | Pb | 206,9  | Vanadium . . .   | V  | 51,2   |
| Lithium . . .    | Li | 7,03   | Xenon . . .      | X  | 128    |
| Magnesium . . .  | Mg | 24,36  | Ytterbium . . .  | Yb | 173    |
| Manganese . . .  | Mn | 55     | Yttrium . . .    | Y  | 89     |
| Mercury . . .    | Hg | 203    | Zinc . . .       | Zn | 65,4   |
| Molybdenum . . . | Mo | 96     | Zirconium . . .  | Zr | 90,7   |

## 2. Comparison of Thermometric scales.

| Centigrade | Réaumur | Fahrenheit | Centigrade | Réaumur | Fahrenheit |
|------------|---------|------------|------------|---------|------------|
| + 100      | + 80    | + 212      | + 54       | + 43,2  | + 129,2    |
| 99         | 79,2    | 210,2      | 53         | 42,4    | 127,4      |
| 98         | 78,4    | 208,4      | 52         | 41,6    | 125,6      |
| 97         | 77,6    | 206,6      | 51         | 40,8    | 123,8      |
| 96         | 76,8    | 204,8      | 50         | 40      | 122        |
| 95         | 76      | 203        | 49         | 39,2    | 120,2      |
| 94         | 75,2    | 201,2      | 48         | 38,4    | 118,4      |
| 93         | 74,4    | 199,4      | 47         | 37,6    | 116,6      |
| 92         | 73,6    | 197,6      | 46         | 36,8    | 114,8      |
| 91         | 72,8    | 195,8      | 45         | 36      | 113        |
| 90         | 72      | 194        | 44         | 35,2    | 111,2      |
| 89         | 71,2    | 192,2      | 43         | 34,4    | 109,4      |
| 88         | 70,4    | 190,4      | 42         | 33,6    | 107,6      |
| 87         | 69,6    | 188,6      | 41         | 32,8    | 105,8      |
| 86         | 68,8    | 186,8      | 40         | 32      | 104        |
| 85         | 68      | 185        | 39         | 31,2    | 102,2      |
| 84         | 67,2    | 183,2      | 38         | 30,4    | 100,4      |
| 83         | 66,4    | 181,4      | 37         | 29,6    | 98,6       |
| 82         | 65,6    | 179,6      | 36         | 28,8    | 96,8       |
| 81         | 64,8    | 177,8      | 35         | 28      | 95         |
| 80         | 64      | 176        | 34         | 27,2    | 93,2       |
| 79         | 63,2    | 174,2      | 33         | 26,4    | 91,4       |
| 78         | 62,4    | 172,4      | 32         | 25,6    | 89,6       |
| 77         | 61,6    | 170,6      | 31         | 24,8    | 87,8       |
| 76         | 60,8    | 168,8      | 30         | 24      | 86         |
| 75         | 60      | 167        | 29         | 23,2    | 84,2       |
| 74         | 59,2    | 165,2      | 28         | 22,4    | 82,4       |
| 73         | 58,4    | 163,4      | 27         | 21,6    | 80,6       |
| 72         | 57,6    | 161,6      | 26         | 20,8    | 78,8       |
| 71         | 56,8    | 159,8      | 25         | 20      | 77         |
| 70         | 56      | 158        | 24         | 19,2    | 75,2       |
| 69         | 55,2    | 156,2      | 23         | 18,4    | 73,4       |
| 68         | 54,4    | 154,4      | 22         | 17,6    | 71,6       |
| 67         | 53,6    | 152,6      | 21         | 16,8    | 69,8       |
| 66         | 52,8    | 150,8      | 20         | 16      | 68         |
| 65         | 52      | 149        | 19         | 15,2    | 66,2       |
| 64         | 51,2    | 147,2      | 18         | 14,4    | 64,4       |
| 63         | 50,4    | 145,4      | 17         | 13,6    | 62,6       |
| 62         | 49,6    | 143,6      | 16         | 12,8    | 60,8       |
| 61         | 48,8    | 141,8      | 15         | 12      | 59         |
| 60         | 48      | 140        | 14         | 11,2    | 57,2       |
| 59         | 47,2    | 138,2      | 13         | 10,4    | 55,4       |
| 58         | 46,4    | 136,4      | 12         | 9,6     | 53,6       |
| 57         | 45,6    | 134,6      | 11         | 8,8     | 51,8       |
| 56         | 44,8    | 132,8      | 10         | 8       | 50         |
| 55         | 44      | 131        | 9          | 7,2     | 48,2       |

| Centigrade | Réaumur | Fahrenheit | Centigrade | Réaumur | Fahrenheit |
|------------|---------|------------|------------|---------|------------|
| + 8        | + 6,4   | + 46,4     | - 17       | - 13,6  | + 1,4      |
| 7          | 5,6     | 44,6       | 18         | 14,4    | - 0,4      |
| 6          | 4,8     | 42,8       | 19         | 15,2    | 2,2        |
| 5          | 4       | 42         | 20         | 16      | 4          |
| 4          | 3,2     | 39,2       | 21         | 16,8    | 5,8        |
| 3          | 2,4     | 37,4       | 22         | 17,6    | 7,6        |
| 2          | 1,6     | 35,6       | 23         | 18,4    | 9,4        |
| 1          | 0,8     | 33,8       | 24         | 19,2    | 11,2       |
| 0          | 0       | 32         | 25         | 20      | 13         |
| - 1        | - 0,8   | 30,2       | 26         | 20,8    | 14,8       |
| 2          | 1,6     | 28,4       | 27         | 21,6    | 16,6       |
| 3          | 2,4     | 26,6       | 28         | 22,4    | 18,4       |
| 4          | 3,2     | 24,8       | 29         | 23,2    | 20,2       |
| 5          | 4       | 23         | 30         | 24      | 22         |
| 6          | 4,8     | 21,2       | 31         | 24,8    | 23,8       |
| 7          | 5,6     | 19,4       | 32         | 25,6    | 25,6       |
| 8          | 6,4     | 17,6       | 33         | 26,4    | 27,4       |
| 9          | 7,2     | 15,8       | 34         | 27,2    | 29,2       |
| 10         | 8       | 14         | 35         | 28      | 31         |
| 11         | 8,8     | 12,2       | 36         | 28,8    | 32,8       |
| 12         | 9,6     | 10,4       | 37         | 29,6    | 34,6       |
| 13         | 10,4    | 8,6        | 38         | 30,4    | 36,4       |
| 14         | 11,2    | 6,8        | 39         | 31,2    | 38,2       |
| 15         | 12      | 5          | 40         | 32      | 40         |
| 16         | 12,8    | 3,2        |            |         |            |

To convert the degrees in one scale into those of another, the following formulæ are used:

- °C to °R multiply by 4, divide by 5,
- °C „ °F „ „ 9, „ „ 5, add 32,
- °R „ °C „ „ 5, „ „ 4,
- °R „ °F „ „ 2, „ „ 4, „ 32,
- °F „ °R subtract 32, multiply by 4, divide by 9,
- °F „ °C „ 32, „ „ 5, „ „ 9.

### 3. Comparative Table of specific Gravities and Hydrometer Degrees, Beaumé and Twaddle.

| Spec.<br>Grav. at<br>59° F. | Degrees<br>Beaumé | Degrees<br>Twaddle | Spec.<br>Grav. at<br>59° F. | Degrees<br>Beaumé | Degrees<br>Twaddle |
|-----------------------------|-------------------|--------------------|-----------------------------|-------------------|--------------------|
| 1,000                       | 0                 | 0                  | 1,225                       | 26,4              | 45                 |
| 1,005                       | 0,7               | 1                  | 1,230                       | 26,9              | 46                 |
| 1,010                       | 1,4               | 2                  | 1,235                       | 27,4              | 47                 |
| 1,015                       | 2,1               | 3                  | 1,240                       | 27,9              | 48                 |
| 1,020                       | 2,7               | 4                  | 1,245                       | 28,4              | 49                 |
| 1,025                       | 3,4               | 5                  | 1,250                       | 28,8              | 50                 |
| 1,030                       | 4,1               | 6                  | 1,255                       | 29,3              | 51                 |
| 1,035                       | 4,7               | 7                  | 1,260                       | 29,7              | 52                 |
| 1,040                       | 5,4               | 8                  | 1,265                       | 30,2              | 53                 |
| 1,045                       | 6,0               | 9                  | 1,270                       | 30,6              | 54                 |
| 1,050                       | 6,7               | 10                 | 1,275                       | 31,1              | 55                 |
| 1,055                       | 7,4               | 11                 | 1,280                       | 31,5              | 56                 |
| 1,060                       | 8,0               | 12                 | 1,285                       | 32,0              | 57                 |
| 1,065                       | 8,7               | 13                 | 1,290                       | 32,4              | 58                 |
| 1,070                       | 9,4               | 14                 | 1,295                       | 32,8              | 59                 |
| 1,075                       | 10,0              | 15                 | 1,300                       | 33,3              | 60                 |
| 1,080                       | 10,6              | 16                 | 1,305                       | 33,7              | 61                 |
| 1,085                       | 11,2              | 17                 | 1,310                       | 34,2              | 62                 |
| 1,090                       | 11,9              | 18                 | 1,315                       | 34,6              | 63                 |
| 1,095                       | 12,4              | 19                 | 1,320                       | 35,0              | 64                 |
| 1,100                       | 13,0              | 20                 | 1,325                       | 35,4              | 65                 |
| 1,105                       | 13,6              | 21                 | 1,330                       | 35,8              | 66                 |
| 1,110                       | 14,2              | 22                 | 1,335                       | 36,2              | 67                 |
| 1,115                       | 14,9              | 23                 | 1,340                       | 36,6              | 68                 |
| 1,120                       | 15,4              | 24                 | 1,345                       | 37,0              | 69                 |
| 1,125                       | 16,0              | 25                 | 1,350                       | 37,4              | 70                 |
| 1,130                       | 16,5              | 26                 | 1,355                       | 37,8              | 71                 |
| 1,135                       | 17,1              | 27                 | 1,360                       | 38,2              | 72                 |
| 1,140                       | 17,7              | 28                 | 1,365                       | 38,6              | 73                 |
| 1,145                       | 18,3              | 29                 | 1,370                       | 39,0              | 74                 |
| 1,150                       | 18,8              | 30                 | 1,375                       | 39,4              | 75                 |
| 1,155                       | 19,3              | 31                 | 1,380                       | 39,8              | 76                 |
| 1,160                       | 19,8              | 32                 | 1,385                       | 40,1              | 77                 |
| 1,165                       | 20,3              | 33                 | 1,390                       | 40,5              | 78                 |
| 1,170                       | 20,9              | 34                 | 1,395                       | 40,8              | 79                 |
| 1,175                       | 21,4              | 35                 | 1,400                       | 41,2              | 80                 |
| 1,180                       | 22,0              | 36                 | 1,405                       | 41,6              | 81                 |
| 1,185                       | 22,5              | 37                 | 1,410                       | 42,0              | 82                 |
| 1,190                       | 23,0              | 38                 | 1,415                       | 42,3              | 83                 |
| 1,195                       | 23,5              | 39                 | 1,420                       | 42,7              | 84                 |
| 1,200                       | 24,0              | 40                 | 1,425                       | 43,1              | 85                 |
| 1,205                       | 24,5              | 41                 | 1,430                       | 43,4              | 86                 |
| 1,210                       | 25,0              | 42                 | 1,435                       | 43,8              | 87                 |
| 1,215                       | 25,5              | 43                 | 1,440                       | 44,1              | 88                 |
| 1,220                       | 26,0              | 44                 | 1,445                       | 44,4              | 89                 |



| Spec.<br>Grav. at<br>59° F. | Degrees<br>Beaumé | Degrees<br>Twaddle | Spec.<br>Grav. at<br>59° F. | Degrees<br>Beaumé | Degrees<br>Twaddle |
|-----------------------------|-------------------|--------------------|-----------------------------|-------------------|--------------------|
| 1,450                       | 44,8              | 90                 | 1,660                       | 57,4              | 132                |
| 1,455                       | 45,1              | 91                 | 1,665                       | 57,7              | 133                |
| 1,460                       | 45,4              | 92                 | 1,670                       | 57,9              | 134                |
| 1,465                       | 45,8              | 93                 | 1,675                       | 58,2              | 135                |
| 1,470                       | 46,1              | 94                 | 1,680                       | 58,4              | 136                |
| 1,475                       | 46,4              | 95                 | 1,685                       | 58,7              | 137                |
| 1,480                       | 46,8              | 96                 | 1,690                       | 58,9              | 138                |
| 1,485                       | 47,1              | 97                 | 1,695                       | 59,2              | 139                |
| 1,490                       | 47,4              | 98                 | 1,700                       | 59,5              | 140                |
| 1,495                       | 47,8              | 99                 | 1,705                       | 59,7              | 141                |
| 1,500                       | 48,1              | 100                | 1,710                       | 60,0              | 142                |
| 1,505                       | 48,4              | 101                | 1,715                       | 60,2              | 143                |
| 1,510                       | 48,7              | 102                | 1,720                       | 60,4              | 144                |
| 1,515                       | 49,0              | 103                | 1,725                       | 60,6              | 145                |
| 1,520                       | 49,4              | 104                | 1,730                       | 60,9              | 146                |
| 1,525                       | 49,7              | 105                | 1,735                       | 61,1              | 147                |
| 1,530                       | 50,0              | 106                | 1,740                       | 61,4              | 148                |
| 1,535                       | 50,3              | 107                | 1,745                       | 61,6              | 149                |
| 1,540                       | 50,6              | 108                | 1,750                       | 61,8              | 150                |
| 1,545                       | 50,9              | 109                | 1,755                       | 62,1              | 151                |
| 1,550                       | 51,2              | 110                | 1,760                       | 62,3              | 152                |
| 1,555                       | 51,5              | 111                | 1,765                       | 62,5              | 153                |
| 1,560                       | 51,8              | 112                | 1,770                       | 62,8              | 154                |
| 1,565                       | 52,1              | 113                | 1,775                       | 63,0              | 155                |
| 1,570                       | 52,4              | 114                | 1,780                       | 63,2              | 156                |
| 1,575                       | 52,7              | 115                | 1,785                       | 63,5              | 157                |
| 1,580                       | 53,0              | 116                | 1,790                       | 63,7              | 158                |
| 1,585                       | 53,3              | 117                | 1,795                       | 64,0              | 159                |
| 1,590                       | 53,6              | 118                | 1,800                       | 64,2              | 160                |
| 1,595                       | 53,9              | 119                | 1,805                       | 64,4              | 161                |
| 1,600                       | 54,1              | 120                | 1,810                       | 64,6              | 162                |
| 1,605                       | 54,4              | 121                | 1,815                       | 64,8              | 163                |
| 1,610                       | 54,7              | 122                | 1,820                       | 65,0              | 164                |
| 1,615                       | 55,0              | 123                | 1,825                       | 65,2              | 165                |
| 1,620                       | 55,2              | 124                | 1,830                       | 65,5              | 166                |
| 1,625                       | 55,5              | 125                | 1,835                       | 65,7              | 167                |
| 1,630                       | 55,8              | 126                | 1,840                       | 65,9              | 168                |
| 1,635                       | 56,0              | 127                | 1,845                       | 66,1              | 169                |
| 1,640                       | 56,3              | 128                | 1,850                       | 66,3              | 170                |
| 1,645                       | 56,6              | 129                | 1,855                       | 66,5              | 171                |
| 1,650                       | 56,9              | 130                | 1,860                       | 66,7              | 172                |
| 1,655                       | 57,1              | 131                | 1,865                       | 67,0              | 173                |

#### 4. Comparative Table of Degrees Beaumé and specific Gravity for liquids of higher specific Gravity than water.

| Degr.<br>Bé | Spec.<br>Grav. at<br>54° F. | Degr.<br>Bé | Spec.<br>Grav. at<br>54° F. | Degr.<br>Bé | Spec.<br>Grav. at<br>54° F. | Degr.<br>Bé | Spec.<br>Grav. at<br>54° F. |
|-------------|-----------------------------|-------------|-----------------------------|-------------|-----------------------------|-------------|-----------------------------|
| 0           | 1,0000                      | 19          | 1,1516                      | 38          | 1,3574                      | 57          | 1,6529                      |
| 1           | 1,0069                      | 20          | 1,1608                      | 39          | 1,3703                      | 58          | 1,6720                      |
| 2           | 1,0140                      | 21          | 1,1702                      | 40          | 1,3834                      | 59          | 1,6916                      |
| 3           | 1,0212                      | 22          | 1,1798                      | 41          | 1,3968                      | 60          | 1,7116                      |
| 4           | 1,0285                      | 23          | 1,1896                      | 42          | 1,4105                      | 61          | 1,7322                      |
| 5           | 1,0358                      | 24          | 1,1994                      | 43          | 1,4244                      | 62          | 1,7532                      |
| 6           | 1,0434                      | 25          | 1,2095                      | 44          | 1,4386                      | 63          | 1,7748                      |
| 7           | 1,0509                      | 26          | 1,2198                      | 45          | 1,4531                      | 64          | 1,7960                      |
| 8           | 1,0587                      | 27          | 1,2301                      | 46          | 1,4678                      | 65          | 1,8195                      |
| 9           | 1,0665                      | 28          | 1,2407                      | 47          | 1,4828                      | 66          | 1,8428                      |
| 10          | 1,0745                      | 29          | 1,2515                      | 48          | 1,4984                      | 67          | 1,839                       |
| 11          | 1,0825                      | 30          | 1,2624                      | 49          | 1,5141                      | 68          | 1,864                       |
| 12          | 1,0907                      | 31          | 1,2736                      | 50          | 1,5301                      | 69          | 1,885                       |
| 13          | 1,0990                      | 32          | 1,2849                      | 51          | 1,5466                      | 70          | 1,909                       |
| 14          | 1,1074                      | 33          | 1,2965                      | 52          | 1,5633                      | 71          | 1,935                       |
| 15          | 1,1160                      | 34          | 1,3082                      | 53          | 1,5804                      | 72          | 1,960                       |
| 16          | 1,1247                      | 35          | 1,3202                      | 54          | 1,5978                      |             |                             |
| 17          | 1,1335                      | 36          | 1,3324                      | 55          | 1,6158                      |             |                             |
| 18          | 1,1425                      | 37          | 1,3447                      | 56          | 1,6342                      |             |                             |

#### 5. Comparative Table of Degrees Beaumé and specific Gravity for liquids of lower specific Gravity than water.

| Degr.<br>Bé | Spec.<br>Grav. at<br>54° F. | Degr.<br>Bé | Spec.<br>Grav. at<br>54° F. | Degr.<br>Bé | Spec.<br>Grav. at<br>54° F. | Degr.<br>Bé | Spec.<br>Grav. at<br>54° F. |
|-------------|-----------------------------|-------------|-----------------------------|-------------|-----------------------------|-------------|-----------------------------|
| 10          | 1,0000                      | 23          | 0,9183                      | 36          | 0,8488                      | 49          | 0,7892                      |
| 11          | 0,9932                      | 24          | 0,9125                      | 37          | 0,8439                      | 50          | 0,7849                      |
| 12          | 0,9865                      | 25          | 0,9068                      | 38          | 0,8391                      | 51          | 0,7807                      |
| 13          | 0,9799                      | 26          | 0,9012                      | 39          | 0,8343                      | 52          | 0,7766                      |
| 14          | 0,9733                      | 27          | 0,8957                      | 40          | 0,8295                      | 53          | 0,7725                      |
| 15          | 0,9669                      | 28          | 0,8902                      | 41          | 0,8249                      | 54          | 0,7684                      |
| 16          | 0,9605                      | 29          | 0,8848                      | 42          | 0,8202                      | 55          | 0,7644                      |
| 17          | 0,9542                      | 30          | 0,8795                      | 43          | 0,8156                      | 56          | 0,7604                      |
| 18          | 0,9480                      | 31          | 0,8742                      | 44          | 0,8111                      | 57          | 0,7565                      |
| 19          | 0,9420                      | 32          | 0,8690                      | 45          | 0,8066                      | 58          | 0,7526                      |
| 20          | 0,9359                      | 33          | 0,8639                      | 46          | 0,8022                      | 59          | 0,7487                      |
| 21          | 0,9300                      | 34          | 0,8588                      | 47          | 0,7978                      | 60          | 0,7449                      |
| 22          | 0,9241                      | 35          | 0,8538                      | 48          | 0,7935                      | 61          | 0,7411                      |

## 6. Specific Gravity of solutions of Ammonia at 15° C. Lunge and Wiernik.

| Specif Grav. | Per- cent NH <sub>3</sub> | 1 litre contains grms NH <sub>3</sub> at 15° C. | Correction for ± 1° C | Specif Grav. | Per- cent NH <sub>3</sub> | 1 litre contains grms NH <sub>3</sub> at 15° C. | Correction for ± 1° C. |
|--------------|---------------------------|-------------------------------------------------|-----------------------|--------------|---------------------------|-------------------------------------------------|------------------------|
|              |                           | *                                               |                       |              |                           | *                                               |                        |
| 1,000        | 0,00                      | 0,0                                             | 0,00018               | 0,940        | 15,63                     | 146,9                                           | 0,00039                |
| 0,998        | 0,45                      | 4,5                                             | 0,00018               | 0,938        | 16,22                     | 152,1                                           | 0,00040                |
| 0,996        | 0,91                      | 9,1                                             | 0,00019               | 0,936        | 16,82                     | 157,4                                           | 0,00041                |
| 0,994        | 1,37                      | 13,6                                            | 0,00019               | 0,934        | 17,42                     | 162,7                                           | 0,00041                |
| 0,992        | 1,84                      | 18,2                                            | 0,00020               | 0,932        | 18,03                     | 168,1                                           | 0,00042                |
| 0,990        | 2,31                      | 22,9                                            | 0,00020               | 0,930        | 18,64                     | 173,4                                           | 0,00042                |
| 0,988        | 2,80                      | 27,7                                            | 0,00021               | 0,928        | 19,25                     | 178,6                                           | 0,00043                |
| 0,986        | 3,30                      | 32,5                                            | 0,00021               | 0,926        | 19,87                     | 184,2                                           | 0,00044                |
| 0,984        | 3,80                      | 37,4                                            | 0,00022               | 0,924        | 20,49                     | 189,3                                           | 0,00045                |
| 0,982        | 4,30                      | 42,2                                            | 0,00022               | 0,922        | 21,12                     | 194,7                                           | 0,00046                |
| 0,980        | 4,80                      | 47,0                                            | 0,00023               | 0,920        | 21,75                     | 200,1                                           | 0,00047                |
| 0,978        | 5,30                      | 51,8                                            | 0,00023               | 0,918        | 22,39                     | 205,6                                           | 0,00048                |
| 0,976        | 5,80                      | 56,6                                            | 0,00024               | 0,916        | 23,03                     | 210,9                                           | 0,00049                |
| 0,974        | 6,30                      | 61,4                                            | 0,00024               | 0,914        | 23,68                     | 216,3                                           | 0,00050                |
| 0,972        | 6,80                      | 66,1                                            | 0,00025               | 0,912        | 24,33                     | 221,9                                           | 0,00051                |
| 0,970        | 7,31                      | 70,9                                            | 0,00025               | 0,910        | 24,99                     | 227,4                                           | 0,00052                |
| 0,968        | 7,82                      | 75,7                                            | 0,00026               | 0,908        | 25,65                     | 232,9                                           | 0,00053                |
| 0,966        | 8,33                      | 80,5                                            | 0,00026               | 0,906        | 26,31                     | 238,3                                           | 0,00054                |
| 0,964        | 8,84                      | 85,2                                            | 0,00027               | 0,904        | 26,98                     | 243,9                                           | 0,00055                |
| 0,962        | 9,35                      | 89,9                                            | 0,00028               | 0,902        | 27,65                     | 249,4                                           | 0,00056                |
| 0,960        | 9,91                      | 95,1                                            | 0,00029               | 0,900        | 28,33                     | 255,0                                           | 0,00057                |
| 0,958        | 10,47                     | 100,3                                           | 0,00030               | 0,898        | 29,01                     | 260,5                                           | 0,00058                |
| 0,956        | 11,03                     | 105,4                                           | 0,00031               | 0,896        | 29,69                     | 266,0                                           | 0,00059                |
| 0,954        | 11,60                     | 110,7                                           | 0,00032               | 0,894        | 30,37                     | 271,5                                           | 0,00060                |
| 0,952        | 12,17                     | 115,9                                           | 0,00033               | 0,892        | 31,05                     | 277,0                                           | 0,00060                |
| 0,950        | 12,74                     | 121,0                                           | 0,00034               | 0,890        | 31,75                     | 282,6                                           | 0,00061                |
| 0,948        | 13,31                     | 126,2                                           | 0,00035               | 0,888        | 32,50                     | 288,6                                           | 0,00062                |
| 0,946        | 13,88                     | 131,3                                           | 0,00036               | 0,886        | 33,25                     | 294,6                                           | 0,00063                |
| 0,944        | 14,46                     | 136,5                                           | 0,00037               | 0,884        | 34,10                     | 301,4                                           | 0,00064                |
| 0,942        | 15,04                     | 141,7                                           | 0,00038               | 0,882        | 34,95                     | 308,3                                           | 0,00065                |

The number of pounds of NH<sub>3</sub> per Gallon is found by dividing by 1000 the number in the column marked. \*

# 7. Specific Gravity of caustic soda at 15° C. (Lunge).

| Spec.<br>Grav. | Degr.<br>Bé | Degrees<br>Twaddle | Per cent<br>Na OH | Spec.<br>Grav. | Degr.<br>Bé | Degrees<br>Twaddle | Per cent<br>Na OH |
|----------------|-------------|--------------------|-------------------|----------------|-------------|--------------------|-------------------|
| 1,007          | 1           | 1,4                | 0,61              | 1,220          | 26          | 44,0               | 19,58             |
| 1,014          | 2           | 2,8                | 1,20              | 1,231          | 27          | 46,2               | 20,59             |
| 1,022          | 3           | 4,4                | 2,00              | 1,241          | 28          | 48,2               | 21,42             |
| 1,029          | 4           | 5,8                | 2,71              | 1,252          | 29          | 50,4               | 22,64             |
| 1,036          | 5           | 7,2                | 3,35              | 1,263          | 30          | 52,6               | 23,67             |
| 1,045          | 6           | 9,0                | 4,00              | 1,274          | 31          | 54,8               | 24,81             |
| 1,052          | 7           | 10,4               | 4,64              | 1,285          | 32          | 57,0               | 25,80             |
| 1,060          | 8           | 12,0               | 5,29              | 1,297          | 33          | 59,4               | 26,83             |
| 1,067          | 9           | 13,4               | 5,87              | 1,308          | 34          | 61,6               | 27,80             |
| 1,075          | 10          | 15,0               | 6,55              | 1,320          | 35          | 64,0               | 28,83             |
| 1,083          | 11          | 16,6               | 7,31              | 1,332          | 36          | 66,4               | 29,93             |
| 1,091          | 12          | 18,2               | 8,00              | 1,345          | 37          | 69,0               | 31,22             |
| 1,100          | 13          | 20,0               | 8,68              | 1,357          | 38          | 71,4               | 32,47             |
| 1,108          | 14          | 21,6               | 9,42              | 1,370          | 39          | 74,0               | 33,69             |
| 1,116          | 15          | 23,2               | 10,06             | 1,383          | 40          | 76,6               | 34,96             |
| 1,125          | 16          | 25,0               | 10,97             | 1,397          | 41          | 79,4               | 36,25             |
| 1,134          | 17          | 26,8               | 11,84             | 1,410          | 42          | 82,0               | 37,47             |
| 1,142          | 18          | 28,4               | 12,64             | 1,424          | 43          | 84,8               | 38,80             |
| 1,152          | 19          | 30,4               | 13,55             | 1,438          | 44          | 87,6               | 39,99             |
| 1,162          | 20          | 32,4               | 14,37             | 1,453          | 45          | 90,6               | 41,41             |
| 1,171          | 21          | 34,2               | 15,13             | 1,468          | 46          | 93,6               | 42,83             |
| 1,180          | 22          | 36,0               | 15,91             | 1,483          | 47          | 96,6               | 44,38             |
| 1,190          | 23          | 38,0               | 16,77             | 1,498          | 48          | 99,6               | 46,15             |
| 1,200          | 24          | 40,0               | 17,67             | 1,514          | 49          | 102,8              | 47,60             |
| 1,210          | 25          | 42,0               | 18,58             | 1,530          | 50          | 106,0              | 49,02             |

# 8. Specific Gravity of Hydrochloric Acid at 15° C. compared with water at 4° C. and reduced to vacuum.

| Spec.<br>Grav.<br>at 15°<br>at 4°<br>(vacuum) | Degrees<br>Beaumé | Degrees<br>Twaddle | 100 parts by weight<br>contain in chem. pure<br>acid |                     | 1 Litre con-<br>tains Kg. |                      |
|-----------------------------------------------|-------------------|--------------------|------------------------------------------------------|---------------------|---------------------------|----------------------|
|                                               |                   |                    | Percent<br>HCl                                       | 20° Acid<br>Percent | HCl                       | Acid<br>at<br>20° Bé |
| 1,090                                         | 0,0               | 0,0                | 0,16                                                 | 0,49                | 0,0016                    | 0,0049               |
| 1,005                                         | 0,7               | 1                  | 1,15                                                 | 3,58                | 0,012                     | 0,036                |
| 1,010                                         | 1,4               | 2                  | 2,14                                                 | 6,66                | 0,022                     | 0,067                |
| 1,015                                         | 2,1               | 3                  | 3,12                                                 | 9,71                | 0,032                     | 0,099                |
| 1,020                                         | 2,7               | 4                  | 4,13                                                 | 12,86               | 0,042                     | 0,131                |
| 1,025                                         | 3,4               | 5                  | 5,15                                                 | 16,04               | 0,053                     | 0,164                |
| 1,030                                         | 4,1               | 6                  | 6,15                                                 | 19,16               | 0,064                     | 0,197                |
| 1,035                                         | 4,7               | 7                  | 7,15                                                 | 22,27               | 0,074                     | 0,231                |
| 1,040                                         | 5,4               | 8                  | 8,16                                                 | 25,42               | 0,085                     | 0,264                |
| 1,045                                         | 6,0               | 9                  | 9,16                                                 | 28,53               | 0,096                     | 0,298                |
| 1,050                                         | 6,7               | 10                 | 10,17                                                | 31,68               | 0,107                     | 0,333                |
| 1,055                                         | 7,4               | 11                 | 11,18                                                | 34,82               | 0,118                     | 0,367                |
| 1,060                                         | 8,0               | 12                 | 12,19                                                | 37,97               | 0,129                     | 0,403                |
| 1,065                                         | 8,7               | 13                 | 13,19                                                | 41,09               | 0,141                     | 0,438                |
| 1,070                                         | 9,4               | 14                 | 14,17                                                | 44,14               | 0,152                     | 0,472                |
| 1,075                                         | 10,0              | 15                 | 15,16                                                | 47,22               | 0,163                     | 0,508                |
| 1,080                                         | 10,6              | 16                 | 16,15                                                | 50,31               | 0,174                     | 0,543                |
| 1,085                                         | 11,2              | 17                 | 17,13                                                | 53,36               | 0,186                     | 0,579                |
| 1,090                                         | 11,9              | 18                 | 18,11                                                | 56,41               | 0,197                     | 0,615                |
| 1,095                                         | 12,4              | 19                 | 19,06                                                | 59,37               | 0,209                     | 0,650                |
| 1,100                                         | 13,0              | 20                 | 20,01                                                | 62,33               | 0,220                     | 0,686                |
| 1,105                                         | 13,6              | 21                 | 20,97                                                | 65,32               | 0,232                     | 0,722                |
| 1,110                                         | 14,2              | 22                 | 21,92                                                | 68,28               | 0,243                     | 0,758                |
| 1,115                                         | 14,9              | 23                 | 22,86                                                | 71,21               | 0,255                     | 0,794                |
| 1,120                                         | 15,4              | 24                 | 23,82                                                | 74,20               | 0,267                     | 0,831                |
| 1,125                                         | 16,0              | 25                 | 24,78                                                | 77,19               | 0,278                     | 0,868                |
| 1,130                                         | 16,5              | 26                 | 25,75                                                | 80,21               | 0,291                     | 0,906                |
| 1,135                                         | 17,1              | 27                 | 26,70                                                | 83,18               | 0,303                     | 0,944                |
| 1,140                                         | 17,7              | 28                 | 27,66                                                | 86,17               | 0,315                     | 0,982                |
| 1,1425                                        | 18,0              |                    | 28,14                                                | 87,66               | 0,322                     | 1,002                |
| 1,145                                         | 18,3              | 29                 | 28,61                                                | 89,13               | 0,328                     | 1,021                |
| 1,150                                         | 18,8              | 30                 | 29,57                                                | 92,11               | 0,340                     | 1,059                |
| 1,152                                         | 19,0              |                    | 29,95                                                | 93,30               | 0,345                     | 1,075                |
| 1,155                                         | 19,3              | 31                 | 30,55                                                | 95,17               | 0,353                     | 1,099                |
| 1,160                                         | 19,8              | 32                 | 31,52                                                | 98,19               | 0,366                     | 1,139                |
| 1,163                                         | 20,0              |                    | 32,10                                                | 100,00              | 0,373                     | 1,163                |
| 1,165                                         | 20,3              | 33                 | 32,49                                                | 101,21              | 0,379                     | 1,179                |
| 1,170                                         | 20,9              | 34                 | 33,46                                                | 104,24              | 0,392                     | 1,220                |
| 1,171                                         | 21,0              |                    | 33,65                                                | 104,82              | 0,394                     | 1,227                |
| 1,175                                         | 21,4              | 35                 | 34,42                                                | 107,22              | 0,404                     | 1,260                |
| 1,180                                         | 22,0              | 36                 | 35,39                                                | 110,24              | 0,418                     | 1,301                |
| 1,185                                         | 22,5              | 37                 | 36,31                                                | 113,11              | 0,430                     | 1,340                |
| 1,190                                         | 23,0              | 38                 | 37,23                                                | 115,98              | 0,443                     | 1,380                |
| 1,195                                         | 23,5              | 39                 | 38,16                                                | 118,87              | 0,456                     | 1,421                |
| 1,200                                         | 24,0              | 40                 | 39,11                                                | 121,84              | 0,469                     | 1,462                |

## 9. Specific Gravity of Nitric Acid.

| Specific Gravity | Degrees Bè | 100 parts contain<br>at 0° C. |                            | 100 parts contain<br>at 15° C. |                            |
|------------------|------------|-------------------------------|----------------------------|--------------------------------|----------------------------|
|                  |            | gr. $\text{HNO}_3$            | gr. $\text{N}_2\text{O}_5$ | gr. $\text{HNO}_3$             | gr. $\text{N}_2\text{O}_5$ |

|       |      |      |      |       |      |
|-------|------|------|------|-------|------|
| 1,000 | 0    | 0,0  | 0,0  | 0,2   | 0,1  |
| 1,007 | 1    | 1,1  | 0,9  | 1,5   | 1,3  |
| 1,014 | 2    | 1,2  | 1,9  | 2,6   | 2,2  |
| 1,022 | 3    | 3,4  | 2,9  | 4,0   | 3,4  |
| 1,029 | 4    | 4,5  | 3,9  | 5,1   | 4,4  |
| 1,036 | 5    | 5,5  | 4,7  | 6,3   | 5,4  |
| 1,044 | 6    | 6,7  | 5,7  | 7,6   | 6,5  |
| 1,052 | 7    | 8,0  | 6,9  | 9,0   | 7,7  |
| 1,060 | 8    | 9,2  | 7,9  | 10,2  | 8,7  |
| 1,067 | 9    | 10,2 | 8,7  | 11,4  | 9,8  |
| 1,075 | 10   | 11,4 | 9,8  | 12,7  | 10,9 |
| 1,083 | 11   | 12,6 | 10,8 | 14,0  | 12,0 |
| 1,091 | 12   | 13,8 | 11,8 | 15,3  | 13,1 |
| 1,100 | 13   | 15,2 | 13,0 | 16,8  | 14,4 |
| 1,108 | 14   | 16,4 | 14,0 | 18,0  | 15,4 |
| 1,116 | 15   | 17,6 | 15,1 | 19,4  | 16,6 |
| 1,125 | 16   | 18,9 | 16,2 | 20,8  | 17,8 |
| 1,134 | 17   | 20,2 | 17,3 | 22,2  | 19,0 |
| 1,143 | 18   | 21,6 | 18,5 | 23,6  | 20,2 |
| 1,152 | 19   | 22,9 | 19,6 | 24,9  | 21,3 |
| 1,161 | 20   | 24,2 | 20,7 | 26,3  | 22,5 |
| 1,171 | 21   | 25,7 | 22,0 | 27,8  | 23,8 |
| 1,180 | 22   | 27,0 | 23,1 | 29,2  | 25,0 |
| 1,190 | 23   | 28,5 | 24,4 | 30,7  | 26,3 |
| 1,199 | 24   | 29,8 | 25,5 | 32,1  | 27,5 |
| 1,210 | 25   | 31,4 | 26,9 | 33,8  | 28,9 |
| 1,221 | 26   | 33,1 | 28,4 | 35,5  | 30,4 |
| 1,231 | 27   | 34,6 | 29,7 | 37,0  | 31,7 |
| 1,242 | 28   | 36,2 | 31,0 | 38,6  | 33,1 |
| 1,252 | 29   | 37,7 | 32,3 | 40,2  | 34,5 |
| 1,261 | 30   | 39,1 | 33,5 | 41,5  | 35,6 |
| 1,275 | 31   | 41,1 | 35,2 | 43,5  | 37,3 |
| 1,286 | 32   | 42,6 | 36,5 | 45,0  | 38,6 |
| 1,298 | 33   | 44,4 | 38,0 | 47,1  | 40,4 |
| 1,309 | 34   | 46,1 | 39,5 | 48,6  | 41,7 |
| 1,321 | 35   | 48,0 | 41,1 | 50,7  | 43,5 |
| 1,334 | 36   | 50,0 | 42,9 | 52,9  | 45,3 |
| 1,346 | 37   | 51,9 | 44,5 | 55,0  | 47,1 |
| 1,359 | 38   | 54,0 | 46,3 | 57,3  | 49,1 |
| 1,372 | 39   | 56,2 | 48,2 | 59,6  | 51,1 |
| 1,384 | 40   | 58,4 | 50,0 | 61,7  | 52,9 |
| 1,398 | 41   | 60,8 | 52,1 | 64,5  | 55,3 |
| 1,412 | 42   | 63,2 | 54,2 | 67,5  | 57,9 |
| 1,426 | 43   | 66,2 | 56,7 | 70,6  | 60,5 |
| 1,440 | 44   | 69,0 | 59,1 | 74,4  | 63,8 |
| 1,454 | 45   | 72,2 | 61,9 | 78,4  | 67,2 |
| 1,470 | 46   | 76,1 | 65,2 | 83,0  | 71,1 |
| 1,485 | 47   | 80,2 | 68,7 | 87,1  | 74,7 |
| 1,501 | 48   | 84,5 | 72,4 | 92,6  | 79,4 |
| 1,516 | 49   | 88,4 | 75,8 | 96,0  | 82,3 |
| 1,524 | 49,5 | 90,5 | 77,6 | 98,0  | 84,0 |
| 1,530 | 49,9 | 92,2 | 79,0 | 100,0 | 85,7 |
| 1,532 | 50,0 | 92,7 | 79,5 |       |      |
| 1,541 | 50,5 | 95,0 | 81,4 |       |      |
| 1,549 | 51   | 97,3 | 83,4 |       |      |

# 10. Specific Gravity of Sulphuric Acid. (Lunge and Isler.)

| Specific Gravity<br>at $\frac{15^{\circ}}{4^{\circ}}$ C.<br>(vacuum) | Degrees Bè |                 | 100 parts<br>by weight<br>contain in<br>chem. pure<br>acid | 1 litre<br>contains<br>in chem.<br>pure acid | Specific Gravity<br>at $\frac{15^{\circ}}{4^{\circ}}$ C.<br>(vacuum) | Degrees Twaddle |                 | 100 parts<br>by weight<br>contain in<br>chem. pure<br>acid | 1 litre<br>contains<br>in chem.<br>pure acid |
|----------------------------------------------------------------------|------------|-----------------|------------------------------------------------------------|----------------------------------------------|----------------------------------------------------------------------|-----------------|-----------------|------------------------------------------------------------|----------------------------------------------|
|                                                                      | Degrees Bè | Degrees Twaddle | Percent<br>H <sub>2</sub> SO <sub>4</sub>                  | Kg.<br>H <sub>2</sub> SO <sub>4</sub>        |                                                                      | Degrees Bè      | Degrees Twaddle | Percent<br>H <sub>2</sub> SO <sub>4</sub>                  | Kg.<br>H <sub>2</sub> SO <sub>4</sub>        |
| 1,000                                                                | 0          | 0               | 0,09                                                       | 0,001                                        | 1,195                                                                | 23,5            | 39              | 26,68                                                      | 0,319                                        |
| 1,005                                                                | 0,7        | 1               | 0,83                                                       | 0,008                                        | 1,200                                                                | 24,0            | 40              | 27,32                                                      | 0,328                                        |
| 1,010                                                                | 1,4        | 2               | 1,57                                                       | 0,016                                        | 1,205                                                                | 24,5            | 41              | 27,95                                                      | 0,337                                        |
| 1,015                                                                | 2,1        | 3               | 2,30                                                       | 0,023                                        | 1,210                                                                | 25,0            | 42              | 28,58                                                      | 0,346                                        |
| 1,020                                                                | 2,7        | 4               | 3,03                                                       | 0,031                                        | 1,215                                                                | 25,5            | 43              | 29,21                                                      | 0,355                                        |
| 1,025                                                                | 3,4        | 5               | 3,76                                                       | 0,039                                        | 1,220                                                                | 26,0            | 44              | 29,84                                                      | 0,364                                        |
| 1,030                                                                | 4,1        | 6               | 4,49                                                       | 0,046                                        | 1,225                                                                | 26,4            | 45              | 30,48                                                      | 0,373                                        |
| 1,035                                                                | 4,7        | 7               | 5,23                                                       | 0,054                                        | 1,230                                                                | 26,9            | 46              | 31,11                                                      | 0,382                                        |
| 1,040                                                                | 5,4        | 8               | 5,96                                                       | 0,062                                        | 1,235                                                                | 27,4            | 47              | 31,70                                                      | 0,391                                        |
| 1,045                                                                | 6,0        | 9               | 6,67                                                       | 0,071                                        | 1,240                                                                | 27,9            | 48              | 32,28                                                      | 0,400                                        |
| 1,050                                                                | 6,7        | 10              | 7,37                                                       | 0,077                                        | 1,245                                                                | 28,4            | 49              | 32,86                                                      | 0,409                                        |
| 1,055                                                                | 7,4        | 11              | 8,07                                                       | 0,085                                        | 1,250                                                                | 28,8            | 50              | 33,43                                                      | 0,418                                        |
| 1,060                                                                | 8,0        | 12              | 8,77                                                       | 0,093                                        | 1,255                                                                | 29,3            | 51              | 34,00                                                      | 0,426                                        |
| 1,065                                                                | 8,7        | 13              | 9,47                                                       | 0,102                                        | 1,260                                                                | 29,7            | 52              | 34,57                                                      | 0,435                                        |
| 1,070                                                                | 9,4        | 14              | 10,19                                                      | 0,109                                        | 1,265                                                                | 30,2            | 53              | 35,14                                                      | 0,444                                        |
| 1,075                                                                | 10,0       | 15              | 10,90                                                      | 0,117                                        | 1,270                                                                | 30,6            | 54              | 35,71                                                      | 0,454                                        |
| 1,080                                                                | 10,6       | 16              | 11,60                                                      | 0,125                                        | 1,275                                                                | 31,1            | 55              | 36,29                                                      | 0,462                                        |
| 1,085                                                                | 11,2       | 17              | 12,30                                                      | 0,133                                        | 1,280                                                                | 31,5            | 56              | 36,87                                                      | 0,472                                        |
| 1,090                                                                | 11,9       | 18              | 12,99                                                      | 0,142                                        | 1,285                                                                | 32,0            | 57              | 37,45                                                      | 0,481                                        |
| 1,095                                                                | 12,4       | 19              | 13,67                                                      | 0,150                                        | 1,290                                                                | 32,4            | 58              | 38,03                                                      | 0,490                                        |
| 1,100                                                                | 13,0       | 20              | 14,35                                                      | 0,158                                        | 1,295                                                                | 32,8            | 59              | 38,61                                                      | 0,500                                        |
| 1,105                                                                | 13,6       | 21              | 15,03                                                      | 0,166                                        | 1,300                                                                | 33,3            | 60              | 39,19                                                      | 0,510                                        |
| 1,110                                                                | 14,2       | 22              | 15,71                                                      | 0,175                                        | 1,305                                                                | 33,7            | 61              | 39,77                                                      | 0,519                                        |
| 1,115                                                                | 14,9       | 23              | 16,38                                                      | 0,183                                        | 1,310                                                                | 34,2            | 62              | 40,35                                                      | 0,529                                        |
| 1,120                                                                | 15,4       | 24              | 17,01                                                      | 0,191                                        | 1,315                                                                | 34,6            | 63              | 40,93                                                      | 0,538                                        |
| 1,125                                                                | 16,0       | 25              | 17,66                                                      | 0,199                                        | 1,320                                                                | 35,0            | 64              | 41,50                                                      | 0,548                                        |
| 1,130                                                                | 16,5       | 26              | 18,31                                                      | 0,207                                        | 1,325                                                                | 35,4            | 65              | 42,08                                                      | 0,557                                        |
| 1,135                                                                | 17,1       | 27              | 18,96                                                      | 0,215                                        | 1,330                                                                | 35,8            | 66              | 42,66                                                      | 0,567                                        |
| 1,140                                                                | 17,7       | 28              | 19,61                                                      | 0,223                                        | 1,335                                                                | 36,2            | 67              | 43,20                                                      | 0,577                                        |
| 1,145                                                                | 18,3       | 29              | 20,26                                                      | 0,231                                        | 1,340                                                                | 36,6            | 68              | 43,74                                                      | 0,586                                        |
| 1,150                                                                | 18,8       | 30              | 20,91                                                      | 0,239                                        | 1,345                                                                | 37,0            | 69              | 44,28                                                      | 0,596                                        |
| 1,155                                                                | 19,3       | 31              | 21,55                                                      | 0,248                                        | 1,350                                                                | 37,4            | 70              | 44,82                                                      | 0,605                                        |
| 1,160                                                                | 19,8       | 32              | 22,19                                                      | 0,257                                        | 1,355                                                                | 37,8            | 71              | 45,35                                                      | 0,614                                        |
| 1,165                                                                | 20,3       | 33              | 22,83                                                      | 0,266                                        | 1,360                                                                | 38,2            | 72              | 45,88                                                      | 0,624                                        |
| 1,170                                                                | 20,9       | 34              | 23,47                                                      | 0,275                                        | 1,365                                                                | 38,6            | 73              | 46,41                                                      | 0,633                                        |
| 1,175                                                                | 21,4       | 35              | 24,12                                                      | 0,283                                        | 1,370                                                                | 39,0            | 74              | 46,94                                                      | 0,643                                        |
| 1,180                                                                | 22,0       | 36              | 24,76                                                      | 0,292                                        | 1,375                                                                | 39,4            | 75              | 47,47                                                      | 0,653                                        |
| 1,185                                                                | 22,5       | 37              | 25,40                                                      | 0,301                                        | 1,380                                                                | 39,8            | 76              | 48,00                                                      | 0,662                                        |
| 1,190                                                                | 23,0       | 38              | 26,04                                                      | 0,310                                        | 1,385                                                                | 40,1            | 77              | 48,53                                                      | 0,672                                        |

| Specific Gravity<br>at $\frac{15^{\circ}}{4^{\circ}}$ C.<br>(vacuum) | Degrees Bè |         | 100 parts<br>by weight<br>contain in<br>chem. pure<br>acid | 1 litre<br>contain<br>in chem.<br>pure acid | Specific Gravity<br>at $\frac{15^{\circ}}{4^{\circ}}$ C.<br>(vacuum) | Degrees Bè |         | 100 parts<br>by weight<br>contain in<br>chem. pure<br>acid | 1 litre<br>contains<br>in chem.<br>pure acid |
|----------------------------------------------------------------------|------------|---------|------------------------------------------------------------|---------------------------------------------|----------------------------------------------------------------------|------------|---------|------------------------------------------------------------|----------------------------------------------|
|                                                                      | Degrees    | Twaddle | Percent<br>H <sub>2</sub> SO <sub>4</sub>                  | Kg.<br>H <sub>2</sub> SO <sub>4</sub>       |                                                                      | Degrees    | Twaddle | Percent<br>H <sub>2</sub> SO <sub>4</sub>                  | Kg.<br>H <sub>2</sub> SO <sub>4</sub>        |
| 1,390                                                                | 40,5       | 78      | 49,06                                                      | 0,682                                       | 1,595                                                                | 53,9       | 119     | 68,05                                                      | 1,085                                        |
| 1,395                                                                | 40,8       | 79      | 49,59                                                      | 0,692                                       | 1,600                                                                | 54,1       | 120     | 68,51                                                      | 1,096                                        |
| 1,400                                                                | 41,2       | 80      | 50,11                                                      | 0,702                                       | 1,605                                                                | 54,4       | 121     | 68,97                                                      | 1,107                                        |
| 1,405                                                                | 41,6       | 81      | 50,63                                                      | 0,711                                       | 1,610                                                                | 54,7       | 122     | 69,43                                                      | 1,118                                        |
| 1,410                                                                | 42,0       | 82      | 51,15                                                      | 0,721                                       | 1,615                                                                | 55,0       | 123     | 69,89                                                      | 1,128                                        |
| 1,415                                                                | 42,3       | 83      | 51,66                                                      | 0,730                                       | 1,620                                                                | 55,2       | 124     | 70,32                                                      | 1,139                                        |
| 1,420                                                                | 42,7       | 84      | 52,15                                                      | 0,740                                       | 1,625                                                                | 55,5       | 125     | 70,74                                                      | 1,150                                        |
| 1,425                                                                | 43,1       | 85      | 52,63                                                      | 0,750                                       | 1,630                                                                | 55,8       | 126     | 71,16                                                      | 1,160                                        |
| 1,430                                                                | 43,4       | 86      | 53,11                                                      | 0,759                                       | 1,635                                                                | 56,0       | 127     | 71,57                                                      | 1,170                                        |
| 1,435                                                                | 43,8       | 87      | 53,59                                                      | 0,769                                       | 1,640                                                                | 56,3       | 128     | 71,99                                                      | 1,181                                        |
| 1,440                                                                | 44,1       | 88      | 54,07                                                      | 0,779                                       | 1,645                                                                | 56,6       | 129     | 72,40                                                      | 1,192                                        |
| 1,445                                                                | 44,4       | 89      | 54,55                                                      | 0,789                                       | 1,650                                                                | 56,9       | 130     | 72,82                                                      | 1,202                                        |
| 1,450                                                                | 44,8       | 90      | 55,03                                                      | 0,798                                       | 1,655                                                                | 57,1       | 131     | 73,23                                                      | 1,212                                        |
| 1,455                                                                | 45,1       | 91      | 55,50                                                      | 0,808                                       | 1,660                                                                | 57,4       | 132     | 73,64                                                      | 1,222                                        |
| 1,460                                                                | 45,4       | 92      | 55,97                                                      | 0,817                                       | 1,665                                                                | 57,7       | 133     | 74,07                                                      | 1,233                                        |
| 1,465                                                                | 45,8       | 93      | 56,43                                                      | 0,827                                       | 1,670                                                                | 57,9       | 134     | 74,51                                                      | 1,244                                        |
| 1,470                                                                | 46,1       | 94      | 56,90                                                      | 0,837                                       | 1,675                                                                | 58,2       | 135     | 74,97                                                      | 1,256                                        |
| 1,475                                                                | 46,4       | 95      | 57,37                                                      | 0,846                                       | 1,680                                                                | 58,4       | 136     | 75,42                                                      | 1,267                                        |
| 1,480                                                                | 46,8       | 96      | 57,83                                                      | 0,856                                       | 1,685                                                                | 58,7       | 137     | 75,86                                                      | 1,278                                        |
| 1,485                                                                | 47,1       | 97      | 58,28                                                      | 0,865                                       | 1,690                                                                | 58,9       | 138     | 76,30                                                      | 1,289                                        |
| 1,490                                                                | 47,4       | 98      | 58,74                                                      | 0,876                                       | 1,695                                                                | 59,2       | 139     | 76,73                                                      | 1,301                                        |
| 1,495                                                                | 47,8       | 99      | 59,22                                                      | 0,885                                       | 1,700                                                                | 59,5       | 140     | 77,17                                                      | 1,312                                        |
| 1,500                                                                | 48,1       | 100     | 59,70                                                      | 0,896                                       | 1,705                                                                | 59,7       | 141     | 77,60                                                      | 1,323                                        |
| 1,505                                                                | 48,4       | 101     | 60,18                                                      | 0,906                                       | 1,710                                                                | 60,0       | 142     | 78,04                                                      | 1,334                                        |
| 1,510                                                                | 48,7       | 102     | 60,65                                                      | 0,916                                       | 1,715                                                                | 60,2       | 143     | 78,48                                                      | 1,346                                        |
| 1,515                                                                | 49,0       | 103     | 61,12                                                      | 0,926                                       | 1,720                                                                | 60,4       | 144     | 78,92                                                      | 1,357                                        |
| 1,520                                                                | 49,4       | 104     | 61,59                                                      | 0,936                                       | 1,725                                                                | 60,6       | 145     | 79,36                                                      | 1,369                                        |
| 1,525                                                                | 49,7       | 105     | 62,06                                                      | 0,946                                       | 1,730                                                                | 60,9       | 146     | 79,80                                                      | 1,381                                        |
| 1,530                                                                | 50,0       | 106     | 62,53                                                      | 0,957                                       | 1,735                                                                | 61,1       | 147     | 80,24                                                      | 1,392                                        |
| 1,535                                                                | 50,3       | 107     | 63,00                                                      | 0,967                                       | 1,740                                                                | 61,4       | 148     | 80,68                                                      | 1,404                                        |
| 1,540                                                                | 50,6       | 108     | 63,43                                                      | 0,977                                       | 1,745                                                                | 61,6       | 149     | 81,12                                                      | 1,416                                        |
| 1,545                                                                | 50,9       | 109     | 63,85                                                      | 0,987                                       | 1,750                                                                | 61,8       | 150     | 81,56                                                      | 1,427                                        |
| 1,550                                                                | 51,2       | 110     | 64,26                                                      | 0,996                                       | 1,755                                                                | 62,1       | 151     | 82,00                                                      | 1,439                                        |
| 1,555                                                                | 51,5       | 111     | 64,67                                                      | 1,006                                       | 1,760                                                                | 62,3       | 152     | 82,44                                                      | 1,451                                        |
| 1,560                                                                | 51,8       | 112     | 65,08                                                      | 1,015                                       | 1,765                                                                | 62,5       | 153     | 82,88                                                      | 1,463                                        |
| 1,565                                                                | 52,1       | 113     | 65,49                                                      | 1,025                                       | 1,770                                                                | 62,8       | 154     | 83,32                                                      | 1,475                                        |
| 1,570                                                                | 52,4       | 114     | 65,90                                                      | 1,035                                       | 1,775                                                                | 63,0       | 155     | 83,90                                                      | 1,489                                        |
| 1,575                                                                | 52,7       | 115     | 66,30                                                      | 1,044                                       | 1,780                                                                | 63,2       | 156     | 84,50                                                      | 1,504                                        |
| 1,580                                                                | 53,0       | 116     | 66,71                                                      | 1,054                                       | 1,785                                                                | 63,5       | 157     | 85,10                                                      | 1,519                                        |
| 1,585                                                                | 53,3       | 117     | 67,13                                                      | 1,064                                       | 1,790                                                                | 63,7       | 158     | 85,70                                                      | 1,534                                        |
| 1,590                                                                | 53,6       | 118     | 67,59                                                      | 1,075                                       | 1,795                                                                | 64,0       | 159     | 86,30                                                      | 1,549                                        |



| Specific Gravity<br>at $15^{\circ}$<br>$\frac{4^{\circ}}{C.}$<br>(vacuum) | Degrees Bè | Degrees Twaddle | 100 parts<br>by weight<br>contain in<br>chem. pure<br>acid | 1 litre<br>contains<br>in chem.<br>pure acid | Specific Gravity<br>at $15^{\circ}$<br>$\frac{4^{\circ}}{C.}$<br>(vacuum) | Degrees Bè | Degrees Twaddle | 100 parts<br>by weight<br>contain in<br>chem. pure<br>acid | 1 litre<br>contains<br>in chem.<br>pure acid |
|---------------------------------------------------------------------------|------------|-----------------|------------------------------------------------------------|----------------------------------------------|---------------------------------------------------------------------------|------------|-----------------|------------------------------------------------------------|----------------------------------------------|
|                                                                           |            |                 | Percent<br>$H_2SO_4$                                       | Kg.<br>$H_2SO_4$                             |                                                                           |            |                 | Percent<br>$H_2SO_4$                                       | Kg.<br>$H_2SO_4$                             |
| 1,800                                                                     | 64,2       | 160             | 86,90                                                      | 1,564                                        | 1,830                                                                     |            | 166             | 92,10                                                      | 1,685                                        |
| 1,805                                                                     | 64,4       | 161             | 87,60                                                      | 1,581                                        | 1,831                                                                     | 65,5       |                 | 92,30                                                      | 1,690                                        |
| 1,810                                                                     | 64,6       | 162             | 88,30                                                      | 1,598                                        | 1,832                                                                     |            |                 | 92,52                                                      | 1,695                                        |
| 1,815                                                                     | 64,8       | 163             | 89,05                                                      | 1,621                                        | 1,833                                                                     | 65,6       |                 | 92,75                                                      | 1,700                                        |
| 1,820                                                                     | 65,0       | 164             | 90,05                                                      | 1,639                                        | 1,834                                                                     |            |                 | 93,05                                                      | 1,706                                        |
| 1,821                                                                     |            |                 | 90,20                                                      | 1,643                                        | 1,835                                                                     | 65,7       | 167             | 93,43                                                      | 1,713                                        |
| 1,822                                                                     | 65,1       |                 | 90,40                                                      | 1,647                                        | 1,836                                                                     |            |                 | 93,80                                                      | 1,722                                        |
| 1,823                                                                     |            |                 | 90,60                                                      | 1,651                                        | 1,837                                                                     |            |                 | 94,20                                                      | 1,730                                        |
| 1,824                                                                     | 65,2       |                 | 90,80                                                      | 1,656                                        | 1,838                                                                     | 65,8       |                 | 94,60                                                      | 1,739                                        |
| 1,825                                                                     |            | 165             | 91,00                                                      | 1,661                                        | 1,839                                                                     |            |                 | 95,00                                                      | 1,748                                        |
| 1,826                                                                     | 65,3       |                 | 91,25                                                      | 1,666                                        | 1,840                                                                     | 65,9       | 168             | 95,60                                                      | 1,759                                        |
| 1,827                                                                     |            |                 | 91,50                                                      | 1,671                                        | 1,8405                                                                    |            |                 | 95,95                                                      | 1,765                                        |
| 1,828                                                                     | 65,4       |                 | 91,70                                                      | 1,676                                        | 1,8410                                                                    |            |                 | 97,00                                                      | 1,786                                        |
| 1,829                                                                     |            |                 | 91,90                                                      | 1,681                                        | 1,8415                                                                    |            |                 | 97,70                                                      | 1,799                                        |

11. Specific Gravity of liquid Sulphurous Acid  
at  $15^{\circ} C.$   
(Scott).

| Spec. Gravity | Percent $SO_2$ | Spec. Gravity | Percent $SO_2$ |
|---------------|----------------|---------------|----------------|
| 1,0028        | 0,5            | 1,0302        | 5,5            |
| 1,0056        | 1,0            | 1,0328        | 6,0            |
| 1,0085        | 1,5            | 1,0353        | 6,5            |
| 1,0113        | 2,0            | 1,0377        | 7,0            |
| 1,0141        | 2,5            | 1,0401        | 7,5            |
| 1,0168        | 3,0            | 1,0426        | 8,0            |
| 1,0194        | 3,5            | 1,0450        | 8,5            |
| 1,0221        | 4,0            | 1,0474        | 9,0            |
| 1,0248        | 4,5            | 1,0497        | 9,5            |
| 1,0275        | 5,0            | 1,0520        | 10,0           |

## 12. Specific Gravity of Acetic Acid at 15° C. (Oudemans).

| Spec.<br>Grav. | Percent<br>C <sub>2</sub> H <sub>4</sub> O <sub>2</sub> | Spec.<br>Grav. | Percent<br>C <sub>2</sub> H <sub>4</sub> O <sub>2</sub> | Spec.<br>Grav. | Percent<br>C <sub>2</sub> H <sub>4</sub> O <sub>2</sub> | Spec.<br>Grav. | Percent<br>C <sub>2</sub> H <sub>4</sub> O <sub>2</sub> |
|----------------|---------------------------------------------------------|----------------|---------------------------------------------------------|----------------|---------------------------------------------------------|----------------|---------------------------------------------------------|
| 0,9992         | 0                                                       | 1,0363         | 26                                                      | 1,0631         | 52                                                      | 1,0748         | 78                                                      |
| 1,0007         | 1                                                       | 1,0375         | 27                                                      | 1,0638         | 53                                                      | 1,0748         | 79                                                      |
| 1,0022         | 2                                                       | 1,0388         | 28                                                      | 1,0646         | 54                                                      | 1,0748         | 80                                                      |
| 1,0037         | 3                                                       | 1,0400         | 29                                                      | 1,0653         | 55                                                      | 1,0747         | 81                                                      |
| 1,0052         | 4                                                       | 1,0412         | 30                                                      | 1,0660         | 56                                                      | 1,0746         | 82                                                      |
| 1,0067         | 5                                                       | 1,0424         | 31                                                      | 1,0666         | 57                                                      | 1,0744         | 83                                                      |
| 1,0083         | 6                                                       | 1,0436         | 32                                                      | 1,0673         | 58                                                      | 1,0742         | 84                                                      |
| 1,0098         | 7                                                       | 1,0447         | 33                                                      | 1,0679         | 59                                                      | 1,0739         | 85                                                      |
| 1,0113         | 8                                                       | 1,0459         | 34                                                      | 1,0685         | 60                                                      | 1,0736         | 86                                                      |
| 1,0127         | 9                                                       | 1,0470         | 35                                                      | 1,0691         | 61                                                      | 1,0731         | 87                                                      |
| 1,0142         | 10                                                      | 1,0481         | 36                                                      | 1,0697         | 62                                                      | 1,0726         | 88                                                      |
| 1,0157         | 11                                                      | 1,0492         | 37                                                      | 1,0702         | 63                                                      | 1,0720         | 89                                                      |
| 1,0171         | 12                                                      | 1,0502         | 38                                                      | 1,0707         | 64                                                      | 1,0713         | 90                                                      |
| 1,0185         | 13                                                      | 1,0513         | 39                                                      | 1,0712         | 65                                                      | 1,0705         | 91                                                      |
| 1,0200         | 14                                                      | 1,0523         | 40                                                      | 1,0717         | 66                                                      | 1,0696         | 92                                                      |
| 1,0214         | 15                                                      | 1,0533         | 41                                                      | 1,0721         | 67                                                      | 1,0686         | 93                                                      |
| 1,0228         | 16                                                      | 1,0543         | 42                                                      | 1,0725         | 68                                                      | 1,0674         | 94                                                      |
| 1,0242         | 17                                                      | 1,0552         | 43                                                      | 1,0729         | 69                                                      | 1,0660         | 95                                                      |
| 1,0256         | 18                                                      | 1,0562         | 44                                                      | 1,0733         | 70                                                      | 1,0644         | 96                                                      |
| 1,0270         | 19                                                      | 1,0571         | 45                                                      | 1,0737         | 71                                                      | 1,0625         | 97                                                      |
| 1,0284         | 20                                                      | 1,0580         | 46                                                      | 1,0740         | 72                                                      | 1,0604         | 98                                                      |
| 1,0298         | 21                                                      | 1,0589         | 47                                                      | 1,0742         | 73                                                      | 1,0580         | 99                                                      |
| 1,0311         | 22                                                      | 1,0598         | 48                                                      | 1,0744         | 74                                                      | 1,0553         | 100                                                     |
| 1,0324         | 23                                                      | 1,0607         | 49                                                      | 1,0746         | 75                                                      |                |                                                         |
| 1,0337         | 24                                                      | 1,0615         | 50                                                      | 1,0747         | 76                                                      |                |                                                         |
| 1,0350         | 25                                                      | 1,0623         | 51                                                      | 1,0748         | 77                                                      |                |                                                         |

Note: Specific Gravity higher than 1.0553 might indicate 2 solutions of different strengths. In order to ascertain, which of the 2 solutions is meant, some water is added: an increase of specific gravity points to the solution being stronger than 78% and a decrease to the solution being weaker than 78%.

## 13. Specific Gravity of Tartaric Acid at 15° C. (Gerlach).

| Spec.<br>Grav. | Percent<br>tart. acid | Spec.<br>Grav. | Percent<br>tart. acid | Spec.<br>Grav. | Percent<br>tart. acid | Spec.<br>Grav. | Percent<br>tart. acid |
|----------------|-----------------------|----------------|-----------------------|----------------|-----------------------|----------------|-----------------------|
| 1,0045         | 1                     | 1,0761         | 16                    | 1,1615         | 32                    | 1,2568         | 48                    |
| 1,0090         | 2                     | 1,0865         | 18                    | 1,1726         | 34                    | 1,2696         | 50                    |
| 1,0179         | 4                     | 1,0969         | 20                    | 1,1840         | 36                    | 1,2828         | 52                    |
| 1,0273         | 6                     | 1,1072         | 22                    | 1,1959         | 38                    | 1,2961         | 54                    |
| 1,0371         | 8                     | 1,1175         | 24                    | 1,2078         | 40                    | 1,3093         | 56                    |
| 1,0469         | 10                    | 1,1282         | 26                    | 1,2198         | 42                    | 1,3220         | 57,9 saturated        |
| 1,0565         | 12                    | 1,1393         | 28                    | 1,2317         | 44                    |                |                       |
| 1,0661         | 14                    | 1,1505         | 30                    | 1,2441         | 46                    |                |                       |

# 14. Specific Gravity of solutions of Tannic Acid at 15° C.

(Trammer.)

| Specific Gravity | Perc. tannic acid | Specific Gravity | Perc. tannic acid | Specific Gravity | Perc. tannic acid | Specific Gravity | Perc. tannic acid |
|------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|-------------------|
| 1,0040           | 1,0               | 1,0092           | 2,3               | 1,0144           | 3,6               | 1,0196           | 4,9               |
| 1,0044           | 1,1               | 1,0096           | 2,4               | 1,0148           | 3,7               | 1,0200           | 5,0               |
| 1,0048           | 1,2               | 1,0100           | 2,5               | 1,0152           | 3,8               | 1,0242           | 6                 |
| 1,0052           | 1,3               | 1,0104           | 2,6               | 1,0156           | 3,9               | 1,0324           | 8                 |
| 1,0056           | 1,4               | 1,0108           | 2,7               | 1,0160           | 4,0               | 1,0406           | 10                |
| 1,0060           | 1,5               | 1,0112           | 2,8               | 1,0164           | 4,1               | 1,0489           | 12                |
| 1,0064           | 1,6               | 1,0116           | 2,9               | 1,0168           | 4,2               | 1,0572           | 14                |
| 1,0068           | 1,7               | 1,0120           | 3,0               | 1,0172           | 4,3               | 1,0656           | 16                |
| 1,0072           | 1,8               | 1,0124           | 3,1               | 1,0176           | 4,4               | 1,0740           | 18                |
| 1,0076           | 1,9               | 1,0128           | 3,2               | 1,0180           | 4,5               | 1,0824           | 20                |
| 1,0080           | 2,0               | 1,0132           | 3,3               | 1,0184           | 4,6               |                  |                   |
| 1,0084           | 2,1               | 1,0136           | 3,4               | 1,0188           | 4,7               |                  |                   |
| 1,0088           | 2,2               | 1,0140           | 3,5               | 1,0192           | 4,8               |                  |                   |

# 15. Specific Gravity of solutions of Sodium Carbonate at 15° C.

(Lunge.)

| Specific Gravity | Degrees Beaumé | Degrees Twaddle | Percentage by weight            |                                          | 1 cbm contains Kg.              |                                          |
|------------------|----------------|-----------------|---------------------------------|------------------------------------------|---------------------------------|------------------------------------------|
|                  |                |                 | Na <sub>2</sub> CO <sub>3</sub> | Na <sub>2</sub> CO <sub>3</sub> + 10 aq. | Na <sub>2</sub> CO <sub>3</sub> | Na <sub>2</sub> CO <sub>3</sub> + 10 aq. |
| 1,007            | 1              | 1,4             | 0,67                            | 1,807                                    | 6,8                             | 18,2                                     |
| 1,014            | 2              | 2,8             | 1,33                            | 3,587                                    | 13,5                            | 36,4                                     |
| 1,022            | 3              | 4,4             | 2,09                            | 5,637                                    | 21,4                            | 57,6                                     |
| 1,029            | 4              | 5,8             | 2,76                            | 7,444                                    | 28,4                            | 76,6                                     |
| 1,036            | 5              | 7,2             | 3,43                            | 9,251                                    | 35,5                            | 95,8                                     |
| 1,045            | 6              | 9,0             | 4,29                            | 11,570                                   | 44,8                            | 120,9                                    |
| 1,052            | 7              | 10,4            | 4,94                            | 13,323                                   | 52,0                            | 140,2                                    |
| 1,060            | 8              | 12,0            | 5,71                            | 15,400                                   | 60,5                            | 163,2                                    |
| 1,067            | 9              | 13,4            | 6,37                            | 17,180                                   | 68,0                            | 183,3                                    |
| 1,075            | 10             | 15,0            | 7,12                            | 19,203                                   | 76,5                            | 206,4                                    |
| 1,083            | 11             | 16,6            | 7,88                            | 21,252                                   | 85,3                            | 230,2                                    |
| 1,091            | 12             | 18,2            | 8,62                            | 23,248                                   | 94,0                            | 253,6                                    |
| 1,100            | 13             | 20,0            | 9,43                            | 25,432                                   | 103,7                           | 279,8                                    |
| 1,108            | 14             | 21,6            | 10,19                           | 27,482                                   | 112,9                           | 304,5                                    |
| 1,116            | 15             | 23,2            | 10,95                           | 29,532                                   | 122,2                           | 329,6                                    |
| 1,125            | 16             | 25,0            | 11,81                           | 31,851                                   | 132,9                           | 358,3                                    |
| 1,134            | 17             | 26,8            | 12,61                           | 34,009                                   | 143,0                           | 385,7                                    |
| 1,142            | 18             | 28,4            | 13,16                           | 35,493                                   | 150,3                           | 405,3                                    |
| 1,152            | 19             | 30,4            | 14,24                           | 38,405                                   | 164,1                           | 442,4                                    |

# 16. Specific Gravity of solutions of Common Salt at 15° C.

(Gerlach.)

| Specific Gravity | Percent Na Cl | Specific Gravity | Percent Na Cl | Specific Gravity | Percent Na Cl |
|------------------|---------------|------------------|---------------|------------------|---------------|
| 1,00725          | 1             | 1,07335          | 10            | 1,14315          | 19            |
| 1,01450          | 2             | 1,08097          | 11            | 1,15107          | 20            |
| 1,02174          | 3             | 1,08859          | 12            | 1,15931          | 21            |
| 1,02899          | 4             | 1,09622          | 13            | 1,16755          | 22            |
| 1,03624          | 5             | 1,10384          | 14            | 1,17580          | 23            |
| 1,04366          | 6             | 1,11146          | 15            | 1,18404          | 24            |
| 1,05108          | 7             | 1,11938          | 16            | 1,19228          | 25            |
| 1,05851          | 8             | 1,12730          | 17            | 1,20098          | 26            |
| 1,06593          | 9             | 1,13523          | 18            | 1,20433          | 26,395        |

# 17. Specific Gravity of solutions of Glauber's Salt at 19° C.

(Schiff.)

| Specific Gravity | Percent Na <sub>2</sub> SO <sub>4</sub> + 10 aq. | Percent Na <sub>2</sub> SO <sub>4</sub> | Specific Gravity | Percent Na <sub>2</sub> SO <sub>4</sub> + 10 aq. | Percent Na <sub>2</sub> SO <sub>4</sub> |
|------------------|--------------------------------------------------|-----------------------------------------|------------------|--------------------------------------------------|-----------------------------------------|
| 1,0040           | 1                                                | 0,441                                   | 1,0642           | 16                                               | 7,056                                   |
| 1,0079           | 2                                                | 0,881                                   | 1,0683           | 17                                               | 7,497                                   |
| 1,0118           | 3                                                | 1,323                                   | 1,0725           | 18                                               | 7,938                                   |
| 1,0158           | 4                                                | 1,764                                   | 1,0766           | 19                                               | 8,379                                   |
| 1,0198           | 5                                                | 2,205                                   | 1,0807           | 20                                               | 8,820                                   |
| 1,0238           | 6                                                | 2,646                                   | 1,0849           | 21                                               | 9,261                                   |
| 1,0278           | 7                                                | 3,087                                   | 1,0890           | 22                                               | 9,702                                   |
| 1,0318           | 8                                                | 3,528                                   | 1,0931           | 23                                               | 10,143                                  |
| 1,0358           | 9                                                | 3,969                                   | 1,0973           | 24                                               | 10,584                                  |
| 1,0398           | 10                                               | 4,410                                   | 1,1015           | 25                                               | 11,025                                  |
| 1,0439           | 11                                               | 4,851                                   | 1,1057           | 26                                               | 11,466                                  |
| 1,0479           | 12                                               | 5,292                                   | 1,1100           | 27                                               | 11,907                                  |
| 1,0520           | 13                                               | 5,733                                   | 1,1142           | 28                                               | 12,348                                  |
| 1,0560           | 14                                               | 6,174                                   | 1,1184           | 29                                               | 12,789                                  |
| 1,0601           | 15                                               | 6,615                                   | 1,1226           | 30                                               | 13,230                                  |

## 18. Specific Gravity of Sodium Bisulphite at 15° C.

| Specific Gravity | Degrees Bé | Percent NaHSO <sub>3</sub> | Percent SO <sub>2</sub> |
|------------------|------------|----------------------------|-------------------------|
| 1,008            | 1          | 1,6                        | 0,4                     |
| 1,022            | 3          | 2,1                        | 1,3                     |
| 1,038            | 5          | 3,6                        | 2,2                     |
| 1,052            | 7          | 5,1                        | 3,1                     |
| 1,068            | 9          | 6,5                        | 3,9                     |
| 1,084            | 11         | 8,0                        | 4,8                     |
| 1,100            | 13         | 9,5                        | 5,7                     |
| 1,116            | 15         | 11,2                       | 6,8                     |
| 1,134            | 17         | 12,8                       | 7,8                     |
| 1,152            | 19         | 14,6                       | 9,0                     |
| 1,171            | 21         | 16,5                       | 10,2                    |
| 1,190            | 23         | 18,5                       | 11,5                    |
| 1,210            | 25         | 20,9                       | 12,9                    |
| 1,230            | 27         | 23,5                       | 14,5                    |
| 1,252            | 29         | 25,9                       | 15,9                    |
| 1,275            | 31         | 28,9                       | 17,8                    |
| 1,298            | 33         | 31,7                       | 19,6                    |
| 1,321            | 35         | 34,7                       | 22,5                    |
| 1,345            | 37         | 38                         | 23,6                    |

## 19. Specific Gravity of solutions of Acetate of Soda at 17,5° C.

(Gerlach.)

| Specific Gravity | Percent<br>NaC <sub>2</sub> H <sub>3</sub> O <sub>2</sub> | Percent<br>NaC <sub>2</sub> H <sub>3</sub> O <sub>2</sub> + 3H <sub>2</sub> O |
|------------------|-----------------------------------------------------------|-------------------------------------------------------------------------------|
| 1,015            | 3,015                                                     | 5                                                                             |
| 1,031            | 6,030                                                     | 10                                                                            |
| 1,047            | 9,045                                                     | 15                                                                            |
| 1,063            | 12,060                                                    | 20                                                                            |
| 1,0795           | 15,075                                                    | 25                                                                            |
| 1,0960           | 18,090                                                    | 30                                                                            |
| 1,1130           | 21,105                                                    | 35                                                                            |
| 1,1305           | 24,120                                                    | 40                                                                            |
| 1,1485           | 27,135                                                    | 45                                                                            |
| 1,1670           | 30,150                                                    | 50                                                                            |

## 20. Specific Gravity of solutions of Chloride of Lime at 15° C.

| Specific Gravity | Degrees Bé | grms active Chlorine per litre |
|------------------|------------|--------------------------------|
| 1,105            | 13,6       | 64                             |
| 1,097            | 12,6       | 60                             |
| 1,087            | 11,5       | 55                             |
| 1,078            | 10,4       | 50                             |
| 1,069            | 9,2        | 45                             |
| 1,060            | 8          | 40                             |
| 1,053            | 7          | 35                             |
| 1,045            | 6          | 30                             |
| 1,037            | 5          | 25                             |
| 1,030            | 4          | 20                             |
| 1,023            | 3          | 15                             |
| 1,015            | 2          | 10                             |
| 1,008            | 1          | 5                              |

## 21. Specific Gravity of solutions of Sulpho-cyanide of Calcium at 17° C.

| Specific Gravity | Degrees Bé | grms Ca (CNS) <sub>2</sub> per litre | grms CaO per litre |
|------------------|------------|--------------------------------------|--------------------|
| 1,132            | 16,7       | 220                                  | 79,4               |
| 1,126            | 16,1       | 210                                  | 75,8               |
| 1,121            | 15,5       | 201,24                               | 72,24              |
| 1,114            | 14,7       | 190                                  | 68,6               |
| 1,108            | 13,9       | 180                                  | 65,0               |
| 1,102            | 13,2       | 170                                  | 61,4               |
| 1,096            | 12,5       | 160                                  | 57,8               |
| 1,090            | 11,9       | 150                                  | 54,2               |
| 1,084            | 11,1       | 140                                  | 50,6               |
| 1,078            | 10,4       | 130                                  | 47,0               |
| 1,072            | 9,6        | 120                                  | 43,4               |
| 1,066            | 8,8        | 110                                  | 39,7               |
| 1,060            | 8,0        | 100                                  | 36,0               |
| 1,054            | 7,3        | 90                                   | 32,4               |
| 1,048            | 6,5        | 80                                   | 28,8               |
| 1,042            | 5,7        | 70                                   | 25,2               |
| 1,036            | 4,9        | 60                                   | 21,6               |
| 1,030            | 4,1        | 50                                   | 18,0               |
| 1,024            | 3,3        | 40                                   | 14,4               |
| 1,018            | 2,5        | 30                                   | 10,8               |
| 1,012            | 1,7        | 20                                   | 7,2                |
| 1,006            | 0,9        | 10                                   | 3,6                |

## 22. Specific Gravity of solutions of Acetate of Calcium at 15° C.

| Specific Gravity | Degrees Bé | Percent<br>Ca (C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> ) <sub>2</sub> |
|------------------|------------|----------------------------------------------------------------------------|
| 1,0260           | 3,4        | 5                                                                          |
| 1,0530           | 7,1        | 10                                                                         |
| 1,0792           | 10,5       | 15                                                                         |
| 1,1051           | 13,6       | 20                                                                         |
| 1,1321           | 16,8       | 25                                                                         |
| 1,1594           | 19,8       | 30                                                                         |

## 23. Specific Gravity of solutions of Chloride of Alumina at 15° C.

(Gerlach.)

| Specif.<br>Grav. | Percent<br>Al <sub>2</sub> Cl <sub>6</sub> | Specif.<br>Grav. | Percent<br>Al <sub>2</sub> Cl <sub>6</sub> | Specif.<br>Grav. | Percent<br>Al <sub>2</sub> Cl <sub>6</sub> | Specif.<br>Grav. | Percent<br>Al <sub>2</sub> Cl <sub>6</sub> |
|------------------|--------------------------------------------|------------------|--------------------------------------------|------------------|--------------------------------------------|------------------|--------------------------------------------|
| 1,00721          | 1                                          | 1,08902          | 12                                         | 1,17953          | 23                                         | 1,28080          | 34                                         |
| 1,01443          | 2                                          | 1,09684          | 13                                         | 1,18815          | 24                                         | 1,29046          | 35                                         |
| 1,02164          | 3                                          | 1,10466          | 14                                         | 1,19676          | 25                                         | 1,30066          | 36                                         |
| 1,02885          | 4                                          | 1,11248          | 15                                         | 1,20584          | 26                                         | 1,31086          | 37                                         |
| 1,03603          | 5                                          | 1,12073          | 16                                         | 1,21493          | 27                                         | 1,32106          | 38                                         |
| 1,04353          | 6                                          | 1,12897          | 17                                         | 1,22406          | 28                                         | 1,33126          | 39                                         |
| 1,05099          | 7                                          | 1,13721          | 18                                         | 1,23310          | 29                                         | 1,34146          | 40                                         |
| 1,05845          | 8                                          | 1,14545          | 19                                         | 1,24219          | 30                                         | 1,35224          | 41                                         |
| 1,06591          | 9                                          | 1,15370          | 20                                         | 1,25184          | 31                                         | 1,35359          | 41,126                                     |
| 1,07337          | 10                                         | 1,16231          | 21                                         | 1,26149          | 32                                         |                  |                                            |
| 1,08120          | 11                                         | 1,17092          | 22                                         | 1,27115          | 33                                         |                  |                                            |

## 24. Specific Gravity of solutions of Chlorate of Alumina at 17° C.

(prepared from Bariumchlorate and Sulphate of Alumina).

| Specific<br>Gravity | Degrees<br>Bé | grms Al <sub>2</sub> O <sub>3</sub><br>per litre | Specific<br>Gravity | Degrees<br>Bé | grms Al <sub>2</sub> O <sub>3</sub><br>per litre |
|---------------------|---------------|--------------------------------------------------|---------------------|---------------|--------------------------------------------------|
| 1,302               | 33,5          | 65                                               | 1,160               | 19,8          | 35                                               |
| 1,277               | 31,3          | 60                                               | 1,138               | 17,4          | 30                                               |
| 1,252               | 29,0          | 55                                               | 1,116               | 15,0          | 25                                               |
| 1,235               | 27,4          | 51,8                                             | 1,095               | 12,4          | 20                                               |
| 1,227               | 26,6          | 50                                               | 1,073               | 9,8           | 15                                               |
| 1,205               | 24,5          | 45                                               | 1,050               | 6,7           | 10                                               |
| 1,182               | 22,2          | 40                                               | 1,026               | 3,5           | 5                                                |

## 25. Specific Gravity of solutions of Sulphate of Alumina at 15° C.

| Specific Gravity | Percent $\text{Al}_2(\text{SO}_4)_3$ | Specific Gravity | Percent $\text{Al}_2(\text{SO}_4)_3$ |
|------------------|--------------------------------------|------------------|--------------------------------------|
| 1,0170           | 1                                    | 1,1467           | 14                                   |
| 1,0270           | 2                                    | 1,1574           | 15                                   |
| 1,0370           | 3                                    | 1,1668           | 16                                   |
| 1,0470           | 4                                    | 1,1770           | 17                                   |
| 1,0569           | 5                                    | 1,1876           | 18                                   |
| 1,0670           | 6                                    | 1,1971           | 19                                   |
| 1,0768           | 7                                    | 1,2074           | 20                                   |
| 1,0870           | 8                                    | 1,2168           | 21                                   |
| 1,0968           | 9                                    | 1,2274           | 22                                   |
| 1,1071           | 10                                   | 1,2375           | 23                                   |
| 1,1171           | 11                                   | 1,2473           | 24                                   |
| 1,1270           | 12                                   | 1,2573           | 25                                   |
| 1,1369           | 13                                   |                  |                                      |

## 26. Specific gravity of solutions of Sulphocyanide of Alumina at 17° C.

(prepared from Sulphocyanide of Barium and Sulphate of Alumina).

| Specific Gravity | Degrees Bé | grms $\text{Al}_2\text{O}_3$ per litre | Specific Gravity | Degrees Bé | grms $\text{Al}_2\text{O}_3$ per litre |
|------------------|------------|----------------------------------------|------------------|------------|----------------------------------------|
| 1,209            | 24,9       | 35                                     | 1,104            | 13,5       | 17,5                                   |
| 1,194            | 23,4       | 32,5                                   | 1,089            | 11,8       | 15                                     |
| 1,179            | 21,9       | 30                                     | 1,074            | 9,9        | 12,5                                   |
| 1,164            | 20,2       | 27,5                                   | 1,059            | 7,9        | 10                                     |
| 1,149            | 18,7       | 25                                     | 1,044            | 5,9        | 7,5                                    |
| 1,135            | 17,1       | 22,6                                   | 1,029            | 4,0        | 5                                      |
| 1,119            | 15,3       | 20                                     | 1,015            | 2,2        | 2,5                                    |

## 27. Specific Gravity of Nitrate of Alumina at 17° C.

| Specific Gravity | Degrees Bé | grms $\text{Al}_2\text{O}_3$ per litre | Specific Gravity | Degrees Bé | grms $\text{Al}_2\text{O}_3$ per litre |
|------------------|------------|----------------------------------------|------------------|------------|----------------------------------------|
| 1,156            | 19,3       | 49,24                                  | 1,091            | 12         | 30                                     |
| 1,145            | 18,3       | 46                                     | 1,075            | 10         | 25                                     |
| 1,135            | 17,1       | 43                                     | 1,059            | 7,9        | 20                                     |
| 1,125            | 16         | 40                                     | 1,043            | 5,8        | 15                                     |
| 1,115            | 14,9       | 37                                     | 1,027            | 3,7        | 10                                     |
| 1,108            | 14         | 35                                     | 1,013            | 1,7        | 5                                      |



## 28. Specific Gravity of solutions of Nitrate-Mordant (Nitro-Acetate of Alumina) at 17° C.

| Specific Gravity | Degrees Bé | grms $\text{Al}_2\text{O}_3$ per litre | Specific Gravity | Degrees Bé | grms $\text{Al}_2\text{O}_3$ per litre |
|------------------|------------|----------------------------------------|------------------|------------|----------------------------------------|
| 1,160            | 19,8       | 56,4                                   | 1,083            | 11,0       | 30                                     |
| 1,156            | 19,4       | 55                                     | 1,068            | 9,1        | 25                                     |
| 1,141            | 17,8       | 50                                     | 1,054            | 7,2        | 20                                     |
| 1,126            | 16,1       | 45                                     | 1,039            | 5,3        | 15                                     |
| 1,112            | 14,4       | 40                                     | 1,025            | 3,4        | 10                                     |
| 1,097            | 12,7       | 35                                     | 1,012            | 1,6        | 5                                      |

## 29. Specific Gravity of solutions of Acetate of Alumina at 17° C.

| Specific Gravity | Degrees Bé | grms $\text{Al}_2\text{O}_3$ per litre |
|------------------|------------|----------------------------------------|
| 1,100            | 13,0       | 40,8                                   |
| 1,098            | 12,8       | 40                                     |
| 1,086            | 11,3       | 35                                     |
| 1,074            | 9,9        | 30                                     |
| 1,062            | 8,3        | 25                                     |
| 1,050            | 6,7        | 20                                     |
| 1,038            | 5,0        | 15                                     |
| 1,025            | 3,4        | 10                                     |
| 1,012            | 1,6        | 5                                      |

## 30. Specific Gravity of solutions of Tartrate of Alumina at 17° C.

| Specific Gravity | Degrees Bé | grms $\text{Al}_2\text{O}_3$ per litre | Specific Gravity | Degrees Bé | grms $\text{Al}_2\text{O}_3$ per litre |
|------------------|------------|----------------------------------------|------------------|------------|----------------------------------------|
| 1,390            | 40,5       | 130                                    | 1,195            | 23,5       | 65                                     |
| 1,375            | 39,4       | 125                                    | 1,180            | 22,0       | 60                                     |
| 1,360            | 38,2       | 120                                    | 1,165            | 20,4       | 55                                     |
| 1,345            | 37,0       | 115                                    | 1,150            | 18,8       | 50                                     |
| 1,330            | 35,8       | 110                                    | 1,135            | 17,1       | 45                                     |
| 1,315            | 34,6       | 105                                    | 1,120            | 15,4       | 40                                     |
| 1,300            | 33,3       | 100                                    | 1,105            | 13,6       | 35                                     |
| 1,285            | 32,0       | 95                                     | 1,090            | 11,9       | 30                                     |
| 1,270            | 30,6       | 90                                     | 1,075            | 10,0       | 25                                     |
| 1,255            | 29,3       | 85                                     | 1,060            | 8,0        | 20                                     |
| 1,240            | 27,9       | 80                                     | 1,045            | 6,0        | 15                                     |
| 1,225            | 26,4       | 75                                     | 1,030            | 4,1        | 10                                     |
| 1,210            | 25,0       | 70                                     | 1,015            | 2,1        | 5                                      |

### 31. Specific Gravity of solutions of Tartar emetic at 17,5° C. (Streit.)

| Specific Gravity | Percent tartar emetic | Specific Gravity | Percent tartar emetic | Specific Gravity | Percent tartar emetic |
|------------------|-----------------------|------------------|-----------------------|------------------|-----------------------|
| 1,005            | 0,5                   | 1,015            | 2,5                   | 1,031            | 4,5                   |
| 1,007            | 1,0                   | 1,018            | 3,0                   | 1,035            | 5,0                   |
| 1,009            | 1,5                   | 1,022            | 3,5                   | 1,038            | 5,5                   |
| 1,012            | 2,0                   | 1,027            | 4,0                   | 1,044            | 6,0                   |

### 32. Specific Gravity of solutions of Tin crystals at 15° C. (Gerlach).

| Specific Gravity | Percent Sn Cl <sub>2</sub> + 2 H <sub>2</sub> O | Specific Gravity | Percent Sn Cl <sub>2</sub> + 2 H <sub>2</sub> O | Specific Gravity | Percent Sn Cl <sub>2</sub> + 2 H <sub>2</sub> O |
|------------------|-------------------------------------------------|------------------|-------------------------------------------------|------------------|-------------------------------------------------|
| 1,013            | 2                                               | 1,212            | 28                                              | 1,497            | 54                                              |
| 1,026            | 4                                               | 1,230            | 30                                              | 1,525            | 56                                              |
| 1,040            | 6                                               | 1,249            | 32                                              | 1,554            | 58                                              |
| 1,054            | 8                                               | 1,268            | 34                                              | 1,582            | 60                                              |
| 1,068            | 10                                              | 1,288            | 36                                              | 1,613            | 62                                              |
| 1,083            | 12                                              | 1,309            | 38                                              | 1,644            | 64                                              |
| 1,097            | 14                                              | 1,330            | 40                                              | 1,677            | 66                                              |
| 1,113            | 16                                              | 1,352            | 42                                              | 1,711            | 68                                              |
| 1,128            | 18                                              | 1,374            | 44                                              | 1,745            | 70                                              |
| 1,144            | 20                                              | 1,397            | 46                                              | 1,783            | 72                                              |
| 1,161            | 22                                              | 1,421            | 48                                              | 1,821            | 74                                              |
| 1,177            | 24                                              | 1,445            | 50                                              | 1,840            | 75                                              |
| 1,194            | 26                                              | 1,471            | 52                                              |                  |                                                 |

### 33. Specific Gravity of solutions of Nitro-Perchloride of tin at 15° C.

| Specific Gravity | Degrees Bé | grms Sn per litre | Specific Gravity | Degrees Bé | grms Sn per litre |
|------------------|------------|-------------------|------------------|------------|-------------------|
| 1,024            | 3,3        | 10                | 1,310            | 34,2       | 140               |
| 1,046            | 6,2        | 20                | 1,332            | 36,0       | 150               |
| 1,068            | 9,1        | 30                | 1,354            | 37,7       | 160               |
| 1,090            | 11,9       | 40                | 1,376            | 39,6       | 170               |
| 1,112            | 14,4       | 50                | 1,398            | 41,1       | 180               |
| 1,134            | 17,0       | 60                | 1,420            | 42,7       | 190               |
| 1,156            | 19,4       | 70                | 1,442            | 44,3       | 200               |
| 1,178            | 21,7       | 80                | 1,464            | 45,7       | 210               |
| 1,200            | 24,0       | 90                | 1,486            | 47,2       | 220               |
| 1,222            | 26,2       | 100               | 1,508            | 48,5       | 230               |
| 1,244            | 28,3       | 110               | 1,530            | 50,0       | 240               |
| 1,266            | 30,3       | 120               | 1,552            | 51,4       | 250               |
| 1,288            | 32,3       | 130               | 1,562            | 51,9       | 254,7             |

### 34. Specific Gravity of solutions of Acetate of Tin at 15° C.

| Specific Gravity | Degrees Bé | grms Sn per litre | Specific Gravity | Degrees Bé | grms Sn per litre |
|------------------|------------|-------------------|------------------|------------|-------------------|
| 1,018            | 2,5        | 5                 | 1,115            | 14,9       | 70                |
| 1,025            | 3,4        | 10                | 1,123            | 15,8       | 75                |
| 1,033            | 4,4        | 15                | 1,130            | 16,5       | 80                |
| 1,040            | 5,4        | 20                | 1,137            | 17,4       | 85                |
| 1,048            | 6,4        | 25                | 1,145            | 18,3       | 90                |
| 1,055            | 7,4        | 30                | 1,153            | 19,1       | 95                |
| 1,063            | 8,4        | 35                | 1,160            | 19,8       | 100               |
| 1,070            | 9,4        | 40                | 1,167            | 20,6       | 105               |
| 1,077            | 10,3       | 45                | 1,175            | 21,4       | 110               |
| 1,085            | 11,2       | 50                | 1,183            | 22,3       | 115               |
| 1,093            | 12,1       | 55                | 1,190            | 23,0       | 120               |
| 1,100            | 13,0       | 60                | 1,192            | 23,2       | 121,5             |
| 1,107            | 13,9       | 65                |                  |            |                   |

### 35. Specific Gravity of solutions of Tartrate of Tin at 15° C.

| Specific Gravity | Degrees Bé | grms Sn per litre | Specific Gravity | Degrees Bé | grms Sn per litre |
|------------------|------------|-------------------|------------------|------------|-------------------|
| 1,015            | 2,1        | 5                 | 1,155            | 19,3       | 40                |
| 1,035            | 4,7        | 10                | 1,175            | 21,4       | 45                |
| 1,055            | 7,4        | 15                | 1,195            | 23,5       | 50                |
| 1,075            | 10,0       | 20                | 1,214            | 25,4       | 55                |
| 1,095            | 12,4       | 25                | 1,233            | 27,2       | 60                |
| 1,115            | 14,9       | 30                | 1,252            | 29,0       | 65                |
| 1,135            | 17,1       | 35                | 1,260            | 29,7       | 66,87             |

### 36. Specific Gravity of solutions of Sulphate of Zinc at 15° C. (Gerlach.)

| Specific Gravity | Degrees Bé | Percent Zn SO <sub>4</sub> | Percent Zn SO <sub>4</sub> + 7H <sub>2</sub> O |
|------------------|------------|----------------------------|------------------------------------------------|
| 1,0288           | 3,8        | 2,805                      | 5                                              |
| 1,0593           | 8,0        | 5,611                      | 10                                             |
| 1,0905           | 12,0       | 8,416                      | 15                                             |
| 1,1236           | 17,2       | 11,220                     | 20                                             |
| 1,1574           | 19,5       | 14,027                     | 25                                             |
| 1,1933           | 23,3       | 16,832                     | 30                                             |
| 1,2315           | 27,0       | 19,637                     | 35                                             |
| 1,2709           | 30,7       | 22,443                     | 40                                             |
| 1,3100           | 34,2       | 25,248                     | 45                                             |
| 1,3532           | 37,6       | 28,054                     | 50                                             |
| 1,3986           | 41,0       | 30,859                     | 55                                             |
| 1,4451           | 44,4       | 33,664                     | 60                                             |

### 37. Specific Gravity of solutions of Copper Chloride at 17,5° C. (Franz.)

| Specific Gravity | Degrees Bé | Percent Cu Cl <sub>2</sub> | Specific Gravity | Degrees Bé | Percent Cu Cl <sub>2</sub> |
|------------------|------------|----------------------------|------------------|------------|----------------------------|
| 1,0182           | 2,4        | 2                          | 1,2501           | 28,8       | 22                         |
| 1,0364           | 4,8        | 4                          | 1,2779           | 31,4       | 24                         |
| 1,0548           | 7,4        | 6                          | 1,3058           | 33,8       | 26                         |
| 1,0734           | 9,8        | 8                          | 1,3338           | 36         | 28                         |
| 1,0920           | 12,2       | 10                         | 1,3618           | 38,1       | 30                         |
| 1,1178           | 15,2       | 12                         | 1,3950           | 40,5       | 32                         |
| 1,1436           | 18         | 14                         | 1,4282           | 43,3       | 34                         |
| 1,1696           | 20,9       | 16                         | 1,4615           | 45,5       | 36                         |
| 1,1958           | 23,6       | 18                         | 1,4949           | 47,8       | 38                         |
| 1,2226           | 26,2       | 20                         | 1,5284           | 49,9       | 40                         |

### 38. Specific Gravity of solutions of Sulphate of Copper at 17° C.

| Specific Gravity | Percent Cu SO <sub>4</sub> + 5 H <sub>2</sub> O | Specific Gravity | Percent Cu SO <sub>4</sub> + 5 H <sub>2</sub> O |
|------------------|-------------------------------------------------|------------------|-------------------------------------------------|
| 1,0126           | 2                                               | 1,0933           | 14                                              |
| 1,0254           | 4                                               | 1,1063           | 16                                              |
| 1,0384           | 6                                               | 1,1208           | 18                                              |
| 1,0516           | 8                                               | 1,1354           | 20                                              |
| 1,0649           | 10                                              | 1,1501           | 22                                              |
| 1,0785           | 12                                              | 1,1659           | 24                                              |

### 39. Specific Gravity of solutions of Bisulphite of Nickel at 15° C.

| Specific Gravity | Degrees Bé | grms Ni O per litre | Specific Gravity | Degrees Bé | grms Ni O per litre |
|------------------|------------|---------------------|------------------|------------|---------------------|
| 1,169            | 20,7       | 79                  | 1,084            | 11,0       | 40                  |
| 1,158            | 19,6       | 75                  | 1,073            | 9,8        | 35                  |
| 1,147            | 18,5       | 70                  | 1,063            | 8,4        | 30                  |
| 1,136            | 17,3       | 65                  | 1,052            | 7,0        | 25                  |
| 1,126            | 16,1       | 60                  | 1,042            | 5,7        | 20                  |
| 1,115            | 14,9       | 55                  | 1,031            | 4,3        | 15                  |
| 1,105            | 13,6       | 50                  | 1,021            | 2,9        | 10                  |
| 1,094            | 12,3       | 45                  | 1,010            | 1,4        | 5                   |

#### 40. Specific Gravity of solutions of Acetate of Nickel at 15° C.

| Specific Gravity | Degrees Beaumé | grms NiO<br>per litre |
|------------------|----------------|-----------------------|
| 1,095            | 12,4           | 52                    |
| 1,091            | 12,0           | 50                    |
| 1,082            | 10,9           | 45                    |
| 1,073            | 9,7            | 40                    |
| 1,064            | 8,6            | 35                    |
| 1,055            | 7,4            | 30                    |
| 1,046            | 6,2            | 25                    |
| 1,037            | 5,0            | 20                    |
| 1,028            | 3,8            | 15                    |
| 1,019            | 2,6            | 10                    |
| 1,010            | 1,4            | 5                     |

#### 41. Specific Gravity of solutions of Chrome-Chloride at 15° C.

| Specific Gravity | Degrees Bé | grms Cr <sub>2</sub> O <sub>3</sub><br>per litre | Specific Gravity | Degrees Bé | grms Cr <sub>2</sub> O <sub>3</sub><br>per litre |
|------------------|------------|--------------------------------------------------|------------------|------------|--------------------------------------------------|
| 1,008            | 1,2        | 5                                                | 1,148            | 18,6       | 90                                               |
| 1,016            | 2,3        | 10                                               | 1,164            | 20,2       | 100                                              |
| 1,032            | 4,3        | 20                                               | 1,180            | 22,0       | 110                                              |
| 1,048            | 6,5        | 30                                               | 1,197            | 23,8       | 120                                              |
| 1,065            | 8,7        | 40                                               | 1,213            | 25,3       | 130                                              |
| 1,082            | 10,9       | 50                                               | 1,229            | 26,8       | 140                                              |
| 1,098            | 12,9       | 60                                               | 1,245            | 28,4       | 150                                              |
| 1,115            | 14,9       | 70                                               | 1,261            | 29,8       | 160                                              |
| 1,131            | 16,6       | 80                                               | 1,276            | 31,2       | 170                                              |

#### 42. Specific Gravity of solutions of Chrome-Bisulphite at 17° C.

| Specific Gravity | Degrees Bé | grms Cr <sub>2</sub> O <sub>3</sub><br>per litre | Specific Gravity | Degrees Bé | grms Cr <sub>2</sub> O <sub>3</sub><br>per litre |
|------------------|------------|--------------------------------------------------|------------------|------------|--------------------------------------------------|
| 1,160            | 19,8       | 80                                               | 1,080            | 10,6       | 40                                               |
| 1,150            | 18,8       | 75                                               | 1,070            | 9,4        | 35                                               |
| 1,140            | 17,7       | 70                                               | 1,060            | 8,0        | 30                                               |
| 1,130            | 16,5       | 65                                               | 1,050            | 6,7        | 25                                               |
| 1,120            | 15,4       | 60                                               | 1,040            | 5,4        | 20                                               |
| 1,110            | 14,2       | 55                                               | 1,030            | 4,1        | 15                                               |
| 1,100            | 13,0       | 50                                               | 1,020            | 2,7        | 10                                               |
| 1,090            | 11,9       | 45                                               | 1,010            | 1,4        | 5                                                |

### 43. Specific Gravity of solutions of Nitro-Acetate of Chrome at 17° C.

(prepared from Chrome Alum, Nitrate and Acetate of Lead).

| Specific Gravity | Degrees Beaumé | grms Cr <sub>2</sub> O <sub>3</sub> per litre | Specific Gravity | Degrees Beaumé | grms Cr <sub>2</sub> O <sub>3</sub> per litre |
|------------------|----------------|-----------------------------------------------|------------------|----------------|-----------------------------------------------|
| 1,010            | 1,7            | 5                                             | 1,104            | 13,5           | 40                                            |
| 1,025            | 3,4            | 10                                            | 1,117            | 15,1           | 45                                            |
| 1,038            | 5,1            | 15                                            | 1,130            | 16,5           | 50                                            |
| 1,051            | 6,9            | 20                                            | 1,144            | 18,1           | 55                                            |
| 1,064            | 8,6            | 25                                            | 1,158            | 19,5           | 60                                            |
| 1,077            | 10,4           | 30                                            | 1,165            | 20,3           | 62                                            |
| 1,090            | 11,9           | 35                                            |                  |                |                                               |

### 44. Specific Gravity of solutions of sesqui — Acetate of Chrome at 17° C.

| Specific Gravity | Degrees Beaumé | grms Cr <sub>2</sub> O <sub>3</sub> per litre | Specific Gravity | Degrees Beaumé | grms Cr <sub>2</sub> O <sub>3</sub> per litre |
|------------------|----------------|-----------------------------------------------|------------------|----------------|-----------------------------------------------|
| 1,007            | 1              | 5                                             | 1,084            | 11,1           | 60                                            |
| 1,014            | 2              | 10                                            | 1,091            | 12,0           | 65                                            |
| 1,021            | 3              | 15                                            | 1,098            | 12,8           | 70                                            |
| 1,028            | 4              | 20                                            | 1,105            | 13,6           | 75                                            |
| 1,035            | 4,9            | 25                                            | 1,112            | 14,5           | 80                                            |
| 1,042            | 5,8            | 30                                            | 1,119            | 15,3           | 85                                            |
| 1,049            | 6,6            | 35                                            | 1,126            | 16,1           | 90                                            |
| 1,056            | 7,5            | 40                                            | 1,133            | 16,9           | 95                                            |
| 1,063            | 8,4            | 45                                            | 1,140            | 17,6           | 100                                           |
| 1,070            | 9,3            | 50                                            | 1,147            | 18,5           | 105                                           |
| 1,077            | 10,2           | 55                                            | 1,151            | 19             | 107                                           |

### 45. Specific Gravity of solutions of basic Acetate of Chrome at 15° C.

| Specific Gravity | Degrees Beaumé | grms Cr <sub>2</sub> O <sub>3</sub> per litre | Specific Gravity | Degrees Beaumé | grms Cr <sub>2</sub> O <sub>3</sub> per litre |
|------------------|----------------|-----------------------------------------------|------------------|----------------|-----------------------------------------------|
| 1,006            | 1,0            | 5                                             | 1,089            | 11,8           | 70                                            |
| 1,013            | 2,0            | 10                                            | 1,096            | 12,5           | 75                                            |
| 1,019            | 2,7            | 15                                            | 1,102            | 13,2           | 80                                            |
| 1,025            | 3,4            | 20                                            | 1,108            | 13,9           | 85                                            |
| 1,031            | 4,2            | 25                                            | 1,115            | 14,9           | 90                                            |
| 1,037            | 5,0            | 30                                            | 1,122            | 15,7           | 95                                            |
| 1,043            | 5,8            | 35                                            | 1,129            | 16,4           | 100                                           |
| 1,050            | 6,7            | 40                                            | 1,136            | 17,2           | 105                                           |
| 1,056            | 7,5            | 45                                            | 1,143            | 18,0           | 110                                           |
| 1,063            | 8,4            | 50                                            | 1,150            | 18,8           | 115                                           |
| 1,069            | 9,3            | 55                                            | 1,157            | 19,5           | 120                                           |
| 1,076            | 10,1           | 60                                            | 1,161            | 19,9           | 122                                           |
| 1,083            | 11,0           | 65                                            |                  |                |                                               |

### 46. Specific Gravity of Solutions of Chrome Mordant GAI at 15° C.

| Specific Gravity | Degrees Beaumé | Grms $\text{Cr}_2\text{O}_3$ per litre | Specific Gravity | Degrees Beaumé | Grms $\text{Cr}_2\text{O}_3$ per litre |
|------------------|----------------|----------------------------------------|------------------|----------------|----------------------------------------|
| 1,012            | 1,7            | 10                                     | 1,176            | 21,5           | 160                                    |
| 1,023            | 3,1            | 20                                     | 1,187            | 22,7           | 170                                    |
| 1,034            | 4,6            | 30                                     | 1,198            | 23,8           | 180                                    |
| 1,045            | 6,0            | 40                                     | 1,208            | 24,8           | 190                                    |
| 1,056            | 7,6            | 50                                     | 1,219            | 25,9           | 200                                    |
| 1,067            | 9,0            | 60                                     | 1,230            | 26,9           | 210                                    |
| 1,078            | 10,4           | 70                                     | 1,241            | 28,0           | 220                                    |
| 1,089            | 11,8           | 80                                     | 1,252            | 29,0           | 230                                    |
| 1,099            | 12,9           | 90                                     | 1,263            | 30,0           | 240                                    |
| 1,110            | 14,2           | 100                                    | 1,274            | 31,0           | 250                                    |
| 1,121            | 15,5           | 110                                    | 1,285            | 32,0           | 260                                    |
| 1,132            | 16,7           | 120                                    | 1,296            | 32,9           | 270                                    |
| 1,143            | 18,1           | 130                                    | 1,307            | 33,9           | 280                                    |
| 1,154            | 19,2           | 140                                    | 1,318            | 34,9           | 290                                    |
| 1,165            | 20,3           | 150                                    | 1,325            | 35,4           | 296                                    |

### 47. Specific Gravity of Solutions of Chrome Mordant GAI at 15° C.

| Specific Gravity | Degrees Beaumé | Grms $\text{Cr}_2\text{O}_3$ per litre | Specific Gravity | Degrees Beaumé | Grms $\text{Cr}_2\text{O}_3$ per litre |
|------------------|----------------|----------------------------------------|------------------|----------------|----------------------------------------|
| 1,015            | 2,1            | 10                                     | 1,175            | 21,4           | 170                                    |
| 1,025            | 3,4            | 20                                     | 1,185            | 22,5           | 180                                    |
| 1,035            | 4,7            | 30                                     | 1,195            | 23,5           | 190                                    |
| 1,045            | 6,0            | 40                                     | 1,205            | 24,5           | 200                                    |
| 1,055            | 7,4            | 50                                     | 1,215            | 25,5           | 210                                    |
| 1,065            | 8,7            | 60                                     | 1,225            | 26,5           | 220                                    |
| 1,075            | 10,0           | 70                                     | 1,235            | 27,4           | 230                                    |
| 1,085            | 11,2           | 80                                     | 1,245            | 28,4           | 240                                    |
| 1,095            | 12,4           | 90                                     | 1,250            | 29,4           | 250                                    |
| 1,105            | 13,6           | 100                                    | 1,266            | 30,3           | 260                                    |
| 1,115            | 14,9           | 110                                    | 1,276            | 31,3           | 270                                    |
| 1,125            | 16,0           | 120                                    | 1,287            | 32,2           | 280                                    |
| 1,135            | 17,1           | 130                                    | 1,298            | 33,2           | 290                                    |
| 1,145            | 18,3           | 140                                    | 1,309            | 34,1           | 300                                    |
| 1,155            | 19,3           | 150                                    | 1,320            | 35,1           | 310                                    |
| 1,165            | 20,3           | 160                                    | 1,328            | 35,7           | 317,4                                  |

### 48. Specific Gravity of Solutions of Chrome Mordant G AIII at 15° C.

| Specific Gravity | Degrees Beaumé | Grms $\text{Cr}_2\text{O}_3$ per litre | Specific Gravity | Degrees Beaumé | Grms $\text{Cr}_2\text{O}_3$ per litre |
|------------------|----------------|----------------------------------------|------------------|----------------|----------------------------------------|
| 1,011            | 1,6            | 10                                     | 1,170            | 20,9           | 160                                    |
| 1,022            | 3,0            | 20                                     | 1,181            | 22,1           | 170                                    |
| 1,033            | 4,5            | 30                                     | 1,191            | 23,1           | 180                                    |
| 1,044            | 5,9            | 40                                     | 1,202            | 24,2           | 190                                    |
| 1,055            | 7,4            | 50                                     | 1,219            | 25,3           | 200                                    |
| 1,065            | 8,7            | 60                                     | 1,224            | 26,3           | 210                                    |
| 1,076            | 10,1           | 70                                     | 1,235            | 27,4           | 220                                    |
| 1,086            | 11,3           | 80                                     | 1,246            | 28,5           | 230                                    |
| 1,097            | 12,6           | 90                                     | 1,256            | 29,4           | 240                                    |
| 1,108            | 13,9           | 100                                    | 1,267            | 30,4           | 250                                    |
| 1,118            | 15,2           | 110                                    | 1,278            | 31,4           | 260                                    |
| 1,128            | 16,4           | 120                                    | 1,289            | 32,2           | 270                                    |
| 1,139            | 17,6           | 130                                    | 1,300            | 33,3           | 280                                    |
| 1,149            | 18,7           | 140                                    | 1,311            | 34,3           | 290                                    |
| 1,159            | 19,7           | 150                                    | 1,316            | 34,7           | 296                                    |

### 49. Specific Gravity of Solutions of Tartrate of Chrome at 17° C.

| Specific Gravity | Degrees Beaumé | Grms $\text{Cr}_2\text{O}_3$ per litre | Specific Gravity | Degrees Beaumé | Grms $\text{Cr}_2\text{O}_3$ per litre |
|------------------|----------------|----------------------------------------|------------------|----------------|----------------------------------------|
| 1,252            | 29,0           | 110                                    | 1,124            | 15,9           | 55                                     |
| 1,240            | 27,9           | 105                                    | 1,113            | 14,7           | 50                                     |
| 1,228            | 26,7           | 100                                    | 1,102            | 13,3           | 45                                     |
| 1,216            | 25,6           | 95                                     | 1,091            | 12,0           | 40                                     |
| 1,204            | 24,4           | 90                                     | 1,079            | 10,5           | 35                                     |
| 1,192            | 23,2           | 85                                     | 1,067            | 9,0            | 30                                     |
| 1,180            | 22,0           | 80                                     | 1,056            | 7,5            | 25                                     |
| 1,169            | 20,8           | 75                                     | 1,045            | 5,0            | 20                                     |
| 1,157            | 19,5           | 70                                     | 1,034            | 4,6            | 15                                     |
| 1,146            | 18,3           | 65                                     | 1,023            | 3,1            | 10                                     |
| 1,135            | 17,1           | 60                                     | 1,012            | 1,6            | 5                                      |

### 50. Specific Gravity of Solutions of Lactate of Chrome at 17° C.

| Specific Gravity | Degrees Beaumé | Grms $\text{Cr}_2\text{O}_3$ per litre | Specific Gravity | Degrees Beaumé | Grms $\text{Cr}_2\text{O}_3$ per litre |
|------------------|----------------|----------------------------------------|------------------|----------------|----------------------------------------|
| 1,218            | 25,8           | 86                                     | 1,113            | 14,7           | 40                                     |
| 1,205            | 24,5           | 80                                     | 1,101            | 13,2           | 35                                     |
| 1,193            | 23,3           | 75                                     | 1,090            | 11,9           | 30                                     |
| 1,182            | 22,2           | 70                                     | 1,078            | 10,4           | 25                                     |
| 1,170            | 20,9           | 65                                     | 1,067            | 9,0            | 20                                     |
| 1,159            | 19,7           | 60                                     | 1,055            | 7,4            | 15                                     |
| 1,147            | 18,5           | 55                                     | 1,044            | 5,8            | 10                                     |
| 1,136            | 17,2           | 50                                     | 1,022            | 3,0            | 5                                      |
| 1,124            | 15,9           | 45                                     |                  |                |                                        |



## 51. Specific Gravity of Solutions of Pyroligneite of Iron at 18° C.

| Specific Gravity | Degrees Beaumé | Grms $\text{Fe}_2\text{O}_3$<br>per litre |
|------------------|----------------|-------------------------------------------|
| 1,274            | 31,0           | 190                                       |
| 1,266            | 30,3           | 185                                       |
| 1,258            | 29,5           | 180                                       |
| 1,250            | 28,8           | 175                                       |
| 1,242            | 28,0           | 170                                       |
| 1,235            | 27,4           | 165                                       |
| 1,228            | 26,7           | 160                                       |
| 1,221            | 26,1           | 155                                       |
| 1,214            | 25,4           | 150                                       |
| 1,207            | 24,7           | 145                                       |
| 1,200            | 24,0           | 140                                       |
| 1,193            | 23,3           | 135                                       |
| 1,186            | 22,6           | 130                                       |
| 1,179            | 21,9           | 125                                       |
| 1,172            | 21,2           | 120                                       |
| 1,165            | 20,3           | 115                                       |
| 1,158            | 19,6           | 110                                       |
| 1,151            | 18,9           | 105                                       |
| 1,144            | 18,2           | 100                                       |
| 1,137            | 17,4           | 95                                        |
| 1,130            | 16,5           | 90                                        |
| 1,123            | 15,7           | 85                                        |
| 1,116            | 15,0           | 80                                        |
| 1,109            | 14,1           | 75                                        |
| 1,102            | 13,2           | 70                                        |
| 1,095            | 12,4           | 65                                        |
| 1,088            | 11,7           | 60                                        |
| 1,081            | 10,7           | 55                                        |
| 1,074            | 9,9            | 50                                        |
| 1,067            | 9,0            | 45                                        |
| 1,060            | 8,0            | 40                                        |
| 1,053            | 7,1            | 35                                        |
| 1,046            | 6,1            | 30                                        |
| 1,039            | 5,2            | 25                                        |
| 1,032            | 4,3            | 20                                        |
| 1,025            | 3,4            | 15                                        |
| 1,018            | 2,4            | 10                                        |
| 1,010            | 1,4            | 5                                         |

## 52. Specific Gravity of Ferrous Sulphate (Copperas) at 15° C.

| Specific Gravity | Percent<br>$\text{FeSO}_4 + 7\text{aq.}$ | Specific Gravity | Percent<br>$\text{FeSO}_4 + 7\text{aq.}$ |
|------------------|------------------------------------------|------------------|------------------------------------------|
| 1,011            | 2                                        | 1,082            | 15                                       |
| 1,021            | 4                                        | 1,112            | 20                                       |
| 1,032            | 6                                        | 1,143            | 25                                       |
| 1,043            | 8                                        | 1,174            | 30                                       |
| 1,054            | 10                                       | 1,206            | 35                                       |
| 1,065            | 12                                       | 1,239            | 40                                       |

# 53. Specific Gravity of Ethyl Alcohol and Percentage by weight at 60° F.

(Fownes.)

| Specific Gravity | Percent by weight $C_2H_5O$ | Specific Gravity | Percent by weight $C_2H_5O$ | Specific Gravity | Percent by weight $C_2H_5O$ |
|------------------|-----------------------------|------------------|-----------------------------|------------------|-----------------------------|
| 0,9991           | 0,5                         | 0,9511           | 34                          | 0,8769           | 68                          |
| 0,9981           | 1                           | 0,9490           | 35                          | 0,8745           | 69                          |
| 0,9965           | 2                           | 0,9470           | 36                          | 0,8721           | 70                          |
| 0,9947           | 3                           | 0,9452           | 37                          | 0,8696           | 71                          |
| 0,9930           | 4                           | 0,9434           | 38                          | 0,8672           | 72                          |
| 0,9914           | 5                           | 0,9416           | 39                          | 0,8649           | 73                          |
| 0,9898           | 6                           | 0,9396           | 40                          | 0,8625           | 74                          |
| 0,9884           | 7                           | 0,9376           | 41                          | 0,8603           | 75                          |
| 0,9869           | 8                           | 0,9356           | 42                          | 0,8581           | 76                          |
| 0,9855           | 9                           | 0,9335           | 43                          | 0,8557           | 77                          |
| 0,9841           | 10                          | 0,9314           | 44                          | 0,8535           | 78                          |
| 0,9828           | 11                          | 0,9292           | 45                          | 0,8508           | 79                          |
| 0,9815           | 12                          | 0,9270           | 46                          | 0,8483           | 80                          |
| 0,9802           | 13                          | 0,9249           | 47                          | 0,8459           | 81                          |
| 0,9789           | 14                          | 0,9228           | 48                          | 0,8434           | 82                          |
| 0,9778           | 15                          | 0,9206           | 49                          | 0,8408           | 83                          |
| 0,9766           | 16                          | 0,9184           | 50                          | 0,8382           | 84                          |
| 0,9753           | 17                          | 0,9160           | 51                          | 0,8357           | 85                          |
| 0,9741           | 18                          | 0,9135           | 52                          | 0,8331           | 86                          |
| 0,9728           | 19                          | 0,9113           | 53                          | 0,8305           | 87                          |
| 0,9716           | 20                          | 0,9090           | 54                          | 0,8279           | 88                          |
| 0,9704           | 21                          | 0,9069           | 55                          | 0,8254           | 89                          |
| 0,9691           | 22                          | 0,9047           | 56                          | 0,8228           | 90                          |
| 0,9678           | 23                          | 0,9025           | 57                          | 0,8199           | 91                          |
| 0,9665           | 24                          | 0,9001           | 58                          | 0,8172           | 92                          |
| 0,9652           | 25                          | 0,8979           | 59                          | 0,8145           | 93                          |
| 0,9638           | 26                          | 0,8956           | 60                          | 0,8118           | 94                          |
| 0,9623           | 27                          | 0,8932           | 61                          | 0,8089           | 95                          |
| 0,9609           | 28                          | 0,8908           | 62                          | 0,8061           | 96                          |
| 0,9593           | 29                          | 0,8886           | 63                          | 0,8031           | 97                          |
| 0,9578           | 30                          | 0,8863           | 64                          | 0,8001           | 98                          |
| 0,9560           | 31                          | 0,8840           | 65                          | 0,7969           | 99                          |
| 0,9544           | 32                          | 0,8816           | 66                          | 0,7938           | 100                         |
| 0,9528           | 33                          | 0,8793           | 67                          |                  |                             |

## 54. Specific Gravity of Solutions of Glycerine.

| Percent Water | Specific Gravity<br>Champion<br>and Pellet | Degrees<br>Beaumé<br>Berthelot | Percent Water | Specific Gravity<br>Champion<br>and Pellet | Degrees<br>Beaumé<br>Berthelot |
|---------------|--------------------------------------------|--------------------------------|---------------|--------------------------------------------|--------------------------------|
| 0,0           | 1,2640                                     | 31,2                           | 11,0          | 1,2350                                     | 28,6                           |
| 0,5           | 1,2625                                     | 31,0                           | 11,5          | 1,2335                                     | 28,4                           |
| 1,0           | 1,2612                                     | 30,9                           | 12,0          | 1,2322                                     | 28,3                           |
| 1,5           | 1,2600                                     | 30,8                           | 12,5          | 1,2307                                     | 28,2                           |
| 2,0           | 1,2585                                     | 30,7                           | 13,0          | 1,2295                                     | 28,0                           |
| 2,5           | 1,2575                                     | 30,6                           | 13,5          | 1,2280                                     | 27,8                           |
| 3,0           | 1,2560                                     | 30,4                           | 14,0          | 1,2270                                     | 27,7                           |
| 3,5           | 1,2545                                     | 30,3                           | 14,5          | 1,2255                                     | 27,6                           |
| 4,0           | 1,2532                                     | 30,2                           | 15,0          | 1,2242                                     | 27,4                           |
| 4,5           | 1,2520                                     | 30,1                           | 15,5          | 1,2230                                     | 27,3                           |
| 5,0           | 1,2505                                     | 30,0                           | 16,0          | 1,2217                                     | 27,2                           |
| 5,5           | 1,2490                                     | 29,9                           | 16,5          | 1,2202                                     | 27,0                           |
| 6,0           | 1,2480                                     | 29,8                           | 17,0          | 1,2190                                     | 26,9                           |
| 6,5           | 1,2465                                     | 29,7                           | 17,5          | 1,2177                                     | 26,8                           |
| 7,0           | 1,2455                                     | 29,6                           | 18,0          | 1,2165                                     | 26,7                           |
| 7,5           | 1,2440                                     | 29,5                           | 18,5          | 1,2150                                     | 26,5                           |
| 8,0           | 1,2427                                     | 29,3                           | 19,0          | 1,2137                                     | 26,4                           |
| 8,5           | 1,2412                                     | 29,2                           | 19,5          | 1,2125                                     | 26,3                           |
| 9,0           | 1,2400                                     | 29,0                           | 20,0          | 1,2112                                     | 26,2                           |
| 9,5           | 1,2390                                     | 28,9                           | 20,5          | 1,2100                                     | 26,0                           |
| 10,0          | 1,2375                                     | 28,8                           | 21,0          | 1,2085                                     | 25,9                           |
| 10,5          | 1,2362                                     | 28,7                           |               |                                            |                                |

## 55. Testing water for its degree of hardness.

**Total degree of hardness.** 100 cc of the sample are filled into a glass stoppered cylinder (of 200 cc capacity) and to this some normal soap solution is gradually added until the froth which is formed in shaking, remains standing over the liquid for 5 min. If the water is harder than 12°, it is diluted: 10 cc of the sample are mixed with 90 cc of distilled water and then tested. The consumed number of cc of normal soap solution indicates the total degree of hardness.

**Constant degree of hardness.** 500 cc of the sample are boiled for 15 min. If any salts are precipitated in boiling, these are filtered and the solution filled up again to 500 cc with distilled water. Of this 100 cc are poured into a glass stoppered cylinder and the test then carried out as described above.

German degrees of hardness indicate milligrammes of CaO in 100 gr. Water, French degrees of hardness refer to milligrammes of Ca CO<sub>3</sub> in 100 gr. Water, English degrees of hardness indicate grains of Ca CO<sub>3</sub> in 1 Gall. of Water.

## 56. Table for determining the hardness of water.

| Soap ccm | German<br>Degrees<br>of hardness | Soap ccm | German<br>Degrees<br>of hardness | Soap ccm | German<br>Degrees<br>of hardness |
|----------|----------------------------------|----------|----------------------------------|----------|----------------------------------|
| 3,4      | 0,5                              | 18,9     | 4,5                              | 34,7     | 8,9                              |
| 4,2      | 0,7                              | 19,7     | 4,7                              | 35,0     | 9,0                              |
| 5,0      | 0,9                              | 20,4     | 4,9                              | 35,3     | 9,1                              |
| 5,4      | 1,0                              | 20,8     | 5,0                              | 36,0     | 9,3                              |
| 5,8      | 1,1                              | 21,2     | 5,1                              | 36,7     | 9,5                              |
| 6,6      | 1,3                              | 21,9     | 5,3                              | 37,4     | 9,7                              |
| 7,4      | 1,5                              | 22,6     | 5,5                              | 38,1     | 9,9                              |
| 8,2      | 1,7                              | 23,3     | 5,7                              | 38,4     | 10,0                             |
| 9,0      | 1,9                              | 24,0     | 5,9                              | 38,7     | 10,1                             |
| 9,4      | 2,0                              | 24,4     | 6,0                              | 39,4     | 10,3                             |
| 9,8      | 2,1                              | 24,8     | 6,1                              | 40,1     | 10,5                             |
| 10,5     | 2,3                              | 25,5     | 6,3                              | 40,8     | 10,7                             |
| 11,3     | 2,5                              | 26,2     | 6,5                              | 41,5     | 10,9                             |
| 12,1     | 2,7                              | 26,9     | 6,7                              | 41,8     | 11,0                             |
| 12,8     | 2,9                              | 27,6     | 6,9                              | 41,9     | 11,1                             |
| 13,2     | 3,0                              | 28,0     | 7,0                              | 42,4     | 11,2                             |
| 13,6     | 3,1                              | 28,4     | 7,1                              | 42,8     | 11,3                             |
| 14,3     | 3,3                              | 29,1     | 7,3                              | 43,1     | 11,4                             |
| 15,1     | 3,5                              | 29,8     | 7,5                              | 43,4     | 11,5                             |
| 15,9     | 3,7                              | 30,5     | 7,7                              | 43,7     | 11,6                             |
| 16,6     | 3,9                              | 31,2     | 7,9                              | 44,0     | 11,7                             |
| 17,0     | 4,0                              | 31,6     | 8,0                              | 44,4     | 11,8                             |
| 17,4     | 4,1                              | 31,9     | 8,1                              | 44,7     | 11,9                             |
| 17,8     | 4,2                              | 32,6     | 8,3                              | 45,0     | 12,0                             |
| 18,1     | 4,3                              | 33,3     | 8,5                              |          |                                  |
| 18,5     | 4,4                              | 34,0     | 8,7                              |          |                                  |

## 57. Comparative table of German, English and French degrees of hardness.

| German | Eng-<br>lish | French | German | Eng-<br>lish | French | German | Eng-<br>lish | French |
|--------|--------------|--------|--------|--------------|--------|--------|--------------|--------|
| 0,5    | 0,62         | 0,9    | 3,92   | 4,9          | 7,0    | 8,5    | 10,63        | 15,18  |
| 0,56   | 0,7          | 1,0    | 4,0    | 5,0          | 7,17   | 8,8    | 11,0         | 15,75  |
| 0,7    | 0,87         | 1,26   | 4,48   | 5,60         | 8,00   | 8,96   | 11,20        | 16,00  |
| 0,8    | 1,0          | 1,43   | 4,5    | 5,63         | 8,06   | 9,0    | 11,25        | 16,08  |
| 1,0    | 1,25         | 1,79   | 4,8    | 6,00         | 8,60   | 9,5    | 11,88        | 17,0   |
| 1,12   | 1,41         | 2,0    | 5,0    | 6,25         | 8,95   | 10,0   | 12,50        | 17,9   |
| 1,5    | 1,88         | 2,69   | 5,04   | 6,30         | 9,00   | 10,08  | 12,6         | 18,0   |
| 1,68   | 2,10         | 3,0    | 5,5    | 6,88         | 9,85   | 10,4   | 13,0         | 18,6   |
| 2,0    | 2,5          | 3,58   | 5,6    | 7,00         | 10,00  | 10,5   | 13,13        | 18,78  |
| 2,24   | 2,8          | 4,0    | 6,0    | 7,5          | 10,74  | 10,64  | 13,3         | 19,0   |
| 2,4    | 3,0          | 4,3    | 6,5    | 8,13         | 11,64  | 11,0   | 13,75        | 19,68  |
| 2,5    | 3,13         | 4,48   | 6,7    | 8,38         | 12,00  | 11,2   | 14,00        | 20,0   |
| 2,8    | 3,5          | 5,0    | 7,0    | 8,75         | 12,55  | 11,5   | 14,38        | 20,59  |
| 3,0    | 3,75         | 5,37   | 7,28   | 9,10         | 13,43  | 11,76  | 14,07        | 21,0   |
| 3,2    | 4,0          | 5,73   | 7,84   | 9,8          | 14,00  | 12,0   | 15,0         | 21,5   |
| 3,36   | 4,2          | 6,0    | 8,0    | 10,0         | 14,30  |        |              |        |
| 3,5    | 4,38         | 6,27   | 8,4    | 10,5         | 15,0   |        |              |        |

## 58. Table for determining the quantity of Acetic Acid required to correct the water.

To 1 litre of water a trace of Methyl Orange is added and normal Hydrochloric Acid 1:10 (10 ccm Hydrochloric Acid 34,2° Tw per litre) poured into it until a change of colour is noticeable. The table shows what quantity of Acetic Acid of different strength is required for the correction of 100 litres of water; (the first column referring to normal Acid 1:10).

| Normal<br>Hydrochloric<br>Acid 1:10<br>ccm per<br>litre water | Grammes of Acetic Acid necessary to correct<br>100 litres water |       |       |       |       |       |       |
|---------------------------------------------------------------|-----------------------------------------------------------------|-------|-------|-------|-------|-------|-------|
|                                                               | 8° Bé                                                           | 7° Bé | 6° Bé | 5° Bé | 4° Bé | 3° Bé | 2° Bé |
| 1                                                             | 1,3                                                             | 1,5   | 2     | 2,4   | 3     | 3,5   | 6     |
| 2                                                             | 2,6                                                             | 3     | 4     | 4,8   | 6     | 7     | 12    |
| 3                                                             | 3,9                                                             | 4,5   | 6     | 7,2   | 9     | 10,5  | 18    |
| 4                                                             | 5,2                                                             | 6     | 8     | 9,6   | 12    | 14    | 24    |
| 5                                                             | 6,5                                                             | 7,5   | 10    | 12    | 15    | 17,5  | 30    |
| 6                                                             | 7,8                                                             | 9     | 12    | 14,4  | 18    | 21    | 36    |
| 7                                                             | 9,1                                                             | 10,5  | 14    | 16,8  | 21    | 24,5  | 42    |
| 8                                                             | 10,4                                                            | 12    | 16    | 19,2  | 24    | 28    | 48    |
| 9                                                             | 11,7                                                            | 13,5  | 18    | 21,6  | 27    | 31,5  | 54    |
| 10                                                            | 13                                                              | 15    | 20    | 24    | 30    | 35    | 60    |
| 11                                                            | 14,3                                                            | 16,5  | 22    | 26,4  | 33    | 38,5  | 66    |
| 12                                                            | 15,6                                                            | 18    | 24    | 28,8  | 36    | 42    | 72    |
| 13                                                            | 16,9                                                            | 19,5  | 26    | 31,2  | 39    | 45,5  | 78    |
| 14                                                            | 18,2                                                            | 21    | 28    | 33,6  | 42    | 49    | 84    |
| 15                                                            | 19,5                                                            | 22,5  | 30    | 36    | 45    | 52,5  | 90    |
| 16                                                            | 20,8                                                            | 24    | 32    | 38,4  | 48    | 56    | 96    |
| 17                                                            | 22,1                                                            | 25,5  | 34    | 40,8  | 51    | 59,5  | 102   |
| 18                                                            | 23,4                                                            | 27    | 36    | 43,2  | 54    | 63    | 108   |
| 19                                                            | 24,7                                                            | 28,5  | 38    | 45,6  | 57    | 66,5  | 114   |
| 20                                                            | 26                                                              | 30    | 40    | 48    | 60    | 70    | 120   |
| 21                                                            | 27,3                                                            | 31,5  | 42    | 50,4  | 63    | 73,5  | 126   |
| 22                                                            | 28,6                                                            | 33    | 44    | 52,8  | 66    | 77    | 132   |
| 23                                                            | 29,9                                                            | 34,5  | 46    | 55,2  | 69    | 80,5  | 138   |
| 24                                                            | 31,2                                                            | 36    | 48    | 57,6  | 72    | 84    | 144   |
| 25                                                            | 32,5                                                            | 37,5  | 50    | 60    | 75    | 87,5  | 150   |
| 26                                                            | 33,8                                                            | 39    | 52    | 62,4  | 78    | 91    | 156   |
| 27                                                            | 35,1                                                            | 40,5  | 54    | 64,8  | 81    | 94,5  | 162   |
| 28                                                            | 36,4                                                            | 42    | 56    | 67,2  | 84    | 98    | 168   |
| 29                                                            | 37,7                                                            | 43,5  | 58    | 69,6  | 87    | 101,5 | 174   |
| 30                                                            | 39                                                              | 45    | 60    | 72    | 90    | 105   | 180   |
| 31                                                            | 40,3                                                            | 46,5  | 62    | 74,4  | 93    | 108,5 | 186   |
| 32                                                            | 41,6                                                            | 48    | 64    | 76,8  | 96    | 112   | 192   |
| 33                                                            | 42,9                                                            | 49,5  | 66    | 79,2  | 99    | 115,5 | 198   |
| 34                                                            | 44,2                                                            | 51    | 68    | 81,6  | 102   | 119   | 204   |

| Normal<br>Hydrochloric<br>Acid 1:10<br>ccm per<br>litre water | Grammes of Acetic Acid necessary to correct<br>100 litres water |       |       |       |       |       |       |
|---------------------------------------------------------------|-----------------------------------------------------------------|-------|-------|-------|-------|-------|-------|
|                                                               | 8° Bè                                                           | 7° Bè | 6° Bè | 5° Bè | 4° Bè | 3° Bè | 2° Bè |
| 35                                                            | 45,5                                                            | 52,5  | 70    | 84    | 105   | 122,5 | 210   |
| 36                                                            | 46,8                                                            | 54    | 72    | 86,4  | 108   | 126   | 216   |
| 37                                                            | 48,1                                                            | 55,5  | 74    | 88,8  | 111   | 129,5 | 222   |
| 38                                                            | 49,4                                                            | 57    | 76    | 91,2  | 114   | 133   | 228   |
| 39                                                            | 50,7                                                            | 58,5  | 78    | 93,6  | 117   | 136,5 | 234   |
| 40                                                            | 52                                                              | 60    | 80    | 96    | 120   | 140   | 240   |
| 41                                                            | 53,3                                                            | 61,5  | 82    | 98,4  | 123   | 143,5 | 246   |
| 42                                                            | 54,6                                                            | 63    | 84    | 100,8 | 126   | 147   | 252   |
| 43                                                            | 55,9                                                            | 64,5  | 86    | 103,2 | 129   | 150,5 | 258   |
| 44                                                            | 57,2                                                            | 66    | 88    | 105,6 | 132   | 154   | 264   |
| 45                                                            | 58,5                                                            | 67,5  | 90    | 108   | 135   | 157,5 | 270   |
| 46                                                            | 59,8                                                            | 69    | 92    | 110,4 | 138   | 161   | 276   |
| 47                                                            | 61,1                                                            | 70,5  | 94    | 112,8 | 141   | 164,5 | 282   |
| 48                                                            | 62,4                                                            | 72    | 96    | 115,2 | 144   | 168   | 288   |
| 49                                                            | 63,7                                                            | 73,5  | 98    | 117,6 | 147   | 171,5 | 294   |
| 50                                                            | 65                                                              | 75    | 100   | 120   | 150   | 175   | 300   |
| 51                                                            | 66,3                                                            | 76,5  | 102   | 122,4 | 153   | 178,5 | 306   |
| 52                                                            | 67,6                                                            | 78    | 104   | 124,8 | 156   | 182   | 312   |
| 53                                                            | 68,9                                                            | 79,5  | 106   | 127,2 | 159   | 185,5 | 318   |
| 54                                                            | 70,2                                                            | 81    | 108   | 129,6 | 162   | 189   | 324   |
| 55                                                            | 71,5                                                            | 82,5  | 110   | 132   | 165   | 192,5 | 330   |
| 56                                                            | 72,8                                                            | 84    | 112   | 134,4 | 168   | 196   | 336   |
| 57                                                            | 74,1                                                            | 85,5  | 114   | 136,8 | 171   | 199,5 | 342   |
| 58                                                            | 75,4                                                            | 87    | 116   | 139,2 | 174   | 203   | 348   |
| 59                                                            | 76,7                                                            | 88,5  | 118   | 141,6 | 177   | 206,5 | 354   |
| 60                                                            | 78                                                              | 90    | 120   | 144   | 180   | 210   | 360   |
| 61                                                            | 79,3                                                            | 91,5  | 122   | 146,4 | 183   | 213,5 | 366   |
| 62                                                            | 80,6                                                            | 93    | 124   | 148,8 | 186   | 217   | 372   |
| 63                                                            | 81,6                                                            | 94,5  | 126   | 151,2 | 189   | 220,5 | 378   |
| 64                                                            | 83,2                                                            | 96    | 128   | 153,6 | 192   | 224   | 384   |
| 65                                                            | 84,5                                                            | 97,5  | 130   | 156   | 195   | 227,5 | 390   |
| 66                                                            | 85,8                                                            | 99    | 132   | 158,4 | 198   | 231   | 396   |
| 67                                                            | 87,1                                                            | 100,5 | 134   | 160,8 | 201   | 234,5 | 402   |
| 68                                                            | 88,4                                                            | 102   | 136   | 163,2 | 204   | 238   | 408   |
| 69                                                            | 89,7                                                            | 103,5 | 138   | 165,6 | 207   | 241,5 | 414   |
| 70                                                            | 91                                                              | 105   | 140   | 168   | 210   | 245   | 420   |
| 71                                                            | 92,3                                                            | 106,5 | 142   | 170,4 | 213   | 248,5 | 426   |
| 72                                                            | 93,6                                                            | 108   | 144   | 172,8 | 216   | 252   | 432   |
| 73                                                            | 94,9                                                            | 109,5 | 146   | 175,2 | 219   | 255,5 | 438   |
| 74                                                            | 96,2                                                            | 111   | 148   | 177,6 | 222   | 259   | 444   |
| 75                                                            | 97,5                                                            | 112,5 | 150   | 180   | 225   | 262,5 | 450   |
| 76                                                            | 98,8                                                            | 114   | 152   | 182,4 | 228   | 266   | 456   |
| 77                                                            | 100,1                                                           | 115,5 | 154   | 184,8 | 231   | 269,5 | 462   |
| 78                                                            | 101,4                                                           | 117   | 156   | 187,2 | 234   | 273   | 468   |
| 79                                                            | 102,7                                                           | 118,5 | 158   | 189,6 | 237   | 276,5 | 474   |
| 80                                                            | 104                                                             | 120   | 160   | 192   | 240   | 280   | 480   |

| Normal<br>Hydrochloric<br>Acid 1:10<br>ccm per<br>litre water | Grammes of Acetic Acid necessary to correct<br>100 litres water |       |       |       |       |       |       |
|---------------------------------------------------------------|-----------------------------------------------------------------|-------|-------|-------|-------|-------|-------|
|                                                               | 8° Bé                                                           | 7° Bé | 6° Bé | 5° Bé | 4° Bé | 3° Bé | 2° Bé |
| 81                                                            | 105,3                                                           | 121,5 | 162   | 194,4 | 243   | 283,4 | 486   |
| 82                                                            | 106,6                                                           | 123   | 164   | 196,8 | 246   | 287   | 492   |
| 83                                                            | 107,9                                                           | 124,5 | 166   | 199,2 | 249   | 290,5 | 498   |
| 84                                                            | 109,2                                                           | 126   | 168   | 201,6 | 252   | 294   | 504   |
| 85                                                            | 110,5                                                           | 127,5 | 170   | 204   | 255   | 297,5 | 510   |
| 86                                                            | 111,8                                                           | 129   | 172   | 206,4 | 258   | 301   | 516   |
| 87                                                            | 113,1                                                           | 130,5 | 174   | 208,8 | 261   | 304,5 | 522   |
| 88                                                            | 114,4                                                           | 132   | 176   | 211,2 | 264   | 308   | 528   |
| 89                                                            | 115,7                                                           | 133,5 | 178   | 213,6 | 267   | 311,5 | 534   |
| 90                                                            | 117                                                             | 135   | 180   | 216   | 270   | 315   | 540   |
| 91                                                            | 118,3                                                           | 136,5 | 182   | 218,4 | 273   | 318,5 | 546   |
| 92                                                            | 119,6                                                           | 138   | 184   | 220,8 | 276   | 322   | 552   |
| 93                                                            | 120,9                                                           | 139,5 | 186   | 223,2 | 279   | 325,5 | 558   |
| 94                                                            | 122,2                                                           | 141   | 188   | 225,6 | 282   | 329   | 564   |
| 95                                                            | 123,5                                                           | 142,5 | 190   | 228   | 285   | 332,5 | 570   |
| 96                                                            | 124,8                                                           | 144   | 192   | 230,4 | 288   | 336   | 576   |
| 97                                                            | 126,1                                                           | 145,5 | 194   | 232,8 | 291   | 339,5 | 582   |
| 98                                                            | 127,4                                                           | 147   | 196   | 235,2 | 294   | 343   | 588   |
| 99                                                            | 128,7                                                           | 148,5 | 198   | 237,6 | 297   | 346,5 | 594   |
| 100                                                           | 130                                                             | 150   | 200   | 240   | 300   | 350   | 600   |

## 59. Soap Analysis.

a) **Water.** A certain quantity (about 3 g) of soap is mixed with perfectly dry sand (about 10 g) in a small porcelain dish and the whole weighed exactly.

After adding a few drops of alcohol to accelerate the evaporation, the sample is gradually dried until a constant weight is obtained. The loss indicated by the difference in weight represents water.

b) **Fatty Acid.** The following method will be found satisfactory for all practical purposes: A certain quantity of soap (3 g) is dissolved in a porcelain dish with water, the fatty Acid then precipitated with normal sulphuric Acid and melted with 10 g dry and pure wax. The wax cake which is easily separated on cooling, is rinsed in cold water and then dried first with Filter paper and then in the Exsiccator until a constant weight is obtained.

c) **Alkali.** The solution of b is neutralized with normal Soda lye (Phenolphthaleine reaction). The number of cc Soda lye, deducted from the number of cc Sulphuric Acid shows the total amount of alkali: 1 cc normal Sulphuric Acid equalling 0.031 g  $\text{Na}_2\text{O}$ .

Another method is to titrate 100 cc soap solution (containing 2—3 g. soap) with normal Acid and Methyl Orange direct, until a red tinge is visible: 1 cc. normal Acid equaling 0.031 g  $\text{Na}_2\text{O}$ .

- d) **Free Alkali.** (Qualitative test) Upon a fresh cross cut of the soap in question a few drops of Mercury chloride solution will produce a brownish yellow to reddish brown colour, according to the amount of free alkali.
- e) **Glycerine.** 20—25 g soap are dissolved in 100 cc Water, then the fatty Acid precipitated with sulphuric Acid (Acid reaction) and removed with wax. The filtrate is neutralised with Potash, evaporated to dryness, powdered and extracted with pure alcohol. The extracted solution is filtered into a glass, of known tare and heated, on a water bath or direct, to 50—60° C. until constant weight is obtained. The remnant is glycerine.
- f) **Unsaponified fat.** Very finely powdered and dried soap (20—25 g) are extracted with Ligroine in the Soxhlet's extraction apparatus for 3—4 h, the ligroine evaporated and the fat weighed. Traces of soap are soluble in Ligroine, therefore a correction is necessary: 100 cc Ligroine dissolve 0.01 Olive Oil soap.

## 60. Turkey Red Oil Analysis.

**Primary test.** The Oil must react slightly alkaline or neutral mixed with water a perfect emulsion must be obtained from which Oil drops are separated after a few hours. These drops must be perfectly soluble in Ammonia, otherwise unsaponified fat is present.

**Water.** According to Stein 10 g Oil are melted with 25 g dry wax in about 75 cc. saturated salt solution. The cake is dried and weighed. The increased weight of wax represents Oil free from water; the difference between 10 or the exact amount of Oil used is Water.

**Fat (total).** 100 cc. Oil are mixed in a graduated cylinder with 20 cc. Hydrochloric Acid (conc.) and then made up with saturated salt solution to 500 cc. The whole is shaken frequently and slightly heated.

On cooling the fat swims on the salt solution. The number of cc shows direct the total amount of fat (this is sufficiently accurate for practical purposes).

## 61. Indigo Analysis.

One gramme of the well dried Indigo sample is weighed into a short wide tube; then 7 ccm Sulphuric Acid 66° Bé are added and the whole heated for  $\frac{1}{2}$  h in steam of about 95° C. The solution is then poured into 100 cc. cold water and then filtered into a 1 litre wash bottle. After washing the filter with hot water until the latter is perfectly colourless, the solution and washwater are filled up to exactly 1 litre.



20 cc of this solution are diluted with 300 cc distilled water in a white porcelain dish of  $\frac{1}{2}$  litre capacity and titrated with a Permanganate solution containing  $\frac{1}{10}$  gramme  $\text{KMnO}_4$  per litre. The Permanganate solution is added in drops while constantly stirring the Indigo solution. The titration is finished, when the blue has changed to gold yellow without any green reflexion.

For comparison a very pure Indigo of known percentage is always analysed simultaneously with the new sample. This enables one to find the percentage of the latter by a simple equation:

A=Indigo of known percentage requires 17.2 cc Permanganate

B= " " unknown " " 16.6 cc "

A=contains 99% Indigo

B= " therefore: B: 99 = 16.6:17.2

B = 95.5%

The result of the titration is generally controlled by a dye test. The same solutions that served for the titration, are used for dyeing. The Indigo of known percentage (the "type") is dyed in 3 different strenghts viz 10 gr. of wool yarn or cloth are dyed with 100, 98 and 96 cc.

The number of cc of the Indigo solution of unknown strength is found by multiplying by 100 the quotient of the titration

$$100 \cdot \frac{17.2}{16.6} = 100 \cdot 1.036 = 103.6 \text{ cc.}$$

Since the dye baths must not contain more than 4% free sulphuric Acid the superfluous Acid of the Indigo solutions must be neutralized with 0.1 cc Soda solution (1:10) for every 1 cc Indigo solution. The varying additions of Soda naturally produce varying amounts of Glauber's salt in the dyebaths. This difference is equalized by adding 2.7 cc Glauber's salt solution (1:10) for every deficient cc of Soda viz: The bath containing the highest percentage of Soda, will require **no** addition of Glauber's salt at all:

A: Type of Indigo (known percentage) } sol 1:1000.  
B: sample of Indigo (unknown percentage) }

- 1) for 100 cc. of A are required 10 cc Soda sol and 0.8 cc Glauber's salt sol
- 2) " 98 " " A " " 9.8 " " " " 1.3 " " " "
- 3) " 96 " " A " " 9.6 " " " " 1.9 " " " "
- 4) " 103.6 " " B " " 10.3 " " " " no Glauber's salt.

For a second dyeing test the baths are prepared as stated above, but 50 cc of Flavazine S are added to each bath. Thus green shades are produced which are easier compared as regards depth and purity of shade than blues.

The dye tests are to be carried out simultaneously under exactly equal conditions as to temperature, time etc. The result will corroborate or correct the figures arrived at by titration.

## Table

showing **Percentage** of colour and corresponding quantityin **grammes** per 100 kilo goods,and **lbs oz** and **grains** per 100 lbs goods.

1 lb = 16 oz = 7000 grains = 454 grammes

1 oz. = 437  $\frac{1}{2}$  grains; 1 gramme = 15.43 grains.0.001 =  $\frac{1}{1000}$  %,0.01 =  $\frac{1}{100}$  %;0.10 =  $\frac{1}{10}$  %.

|       | per 100 kilo | per 100 lbs  |      | per 100 kilo | per 100 lbs  |
|-------|--------------|--------------|------|--------------|--------------|
| %     | grammes      | lb oz grains | %    | grammes      | lb oz grains |
| 0.001 | 1            | 7            | 0.34 | 340          | 5 193        |
| 0.002 | 2            | 14           | 0.35 | 350          | 5 263        |
| 0.003 | 3            | 21           | 0.36 | 360          | 5 333        |
| 0.004 | 4            | 28           | 0.37 | 370          | 5 403        |
| 0.005 | 5            | 35           | 0.38 | 380          | 6 35         |
| 0.006 | 6            | 42           | 0.39 | 390          | 6 105        |
| 0.007 | 7            | 49           | 0.40 | 400          | 6 175        |
| 0.008 | 8            | 56           | 0.41 | 410          | 6 245        |
| 0.009 | 9            | 63           | 0.42 | 420          | 6 315        |
| 0.01  | 10           | 70           | 0.43 | 430          | 6 385        |
| 0.02  | 20           | 140          | 0.44 | 440          | 7 18         |
| 0.03  | 30           | 210          | 0.45 | 450          | 7 88         |
| 0.04  | 40           | 280          | 0.46 | 460          | 7 158        |
| 0.05  | 50           | 350          | 0.47 | 470          | 7 228        |
| 0.06  | 60           | 420          | 0.48 | 480          | 7 298        |
| 0.07  | 70           | 1 53         | 0.49 | 490          | 7 368        |
| 0.08  | 80           | 1 123        | 0.50 | 500          | 8 —          |
| 0.09  | 90           | 1 193        | 0.51 | 510          | 8 70         |
| 0.10  | 100          | 1 263        | 0.52 | 520          | 8 140        |
| 0.11  | 110          | 1 333        | 0.53 | 530          | 8 210        |
| 0.12  | 120          | 1 403        | 0.54 | 540          | 8 280        |
| 0.13  | 130          | 2 35         | 0.55 | 550          | 8 350        |
| 0.14  | 140          | 2 106        | 0.56 | 560          | 8 420        |
| 0.15  | 150          | 2 176        | 0.57 | 570          | 9 53         |
| 0.16  | 160          | 2 246        | 0.58 | 580          | 9 123        |
| 0.17  | 170          | 2 316        | 0.59 | 590          | 9 193        |
| 0.18  | 180          | 2 386        | 0.60 | 600          | 9 263        |
| 0.19  | 190          | 3 18         | 0.61 | 610          | 9 333        |
| 0.20  | 200          | 3 88         | 0.62 | 620          | 9 403        |
| 0.21  | 210          | 3 158        | 0.63 | 630          | 10 35        |
| 0.22  | 220          | 3 229        | 0.64 | 640          | 10 105       |
| 0.23  | 230          | 3 299        | 0.65 | 650          | 10 175       |
| 0.24  | 240          | 3 369        | 0.66 | 660          | 10 245       |
| 0.25  | 250          | 4 —          | 0.67 | 670          | 10 315       |
| 0.26  | 260          | 4 70         | 0.68 | 680          | 10 385       |
| 0.27  | 270          | 4 140        | 0.69 | 690          | 11 18        |
| 0.28  | 280          | 4 210        | 0.70 | 700          | 11 88        |
| 0.29  | 290          | 4 280        | 0.71 | 710          | 11 158       |
| 0.30  | 300          | 4 350        | 0.72 | 720          | 11 228       |
| 0.31  | 310          | 4 420        | 0.73 | 730          | 11 298       |
| 0.32  | 320          | 5 53         | 0.74 | 740          | 11 368       |
| 0.33  | 330          | 5 123        | 0.75 | 750          | 12 —         |

|      | per 100 kilo | per 100 lbs  |      | per 100 kilo | per 100 lbs  |
|------|--------------|--------------|------|--------------|--------------|
| %    | grammes      | lb oz grains | %    | grammes      | lb oz grains |
| 0.76 | 760          | 12 70        | 0.89 | 890          | 14 105       |
| 0.77 | 770          | 12 140       | 0.90 | 900          | 14 175       |
| 0.78 | 780          | 12 210       | 0.91 | 910          | 14 245       |
| 0.79 | 790          | 12 280       | 0.92 | 920          | 14 315       |
| 0.80 | 800          | 12 350       | 0.93 | 930          | 14 385       |
| 0.81 | 810          | 12 420       | 0.94 | 940          | 15 18        |
| 0.82 | 820          | 13 53        | 0.95 | 950          | 15 88        |
| 0.83 | 830          | 13 123       | 0.96 | 960          | 15 158       |
| 0.84 | 840          | 13 193       | 0.97 | 970          | 15 228       |
| 0.85 | 850          | 13 263       | 0.98 | 980          | 15 298       |
| 0.86 | 860          | 13 333       | 0.99 | 990          | 15 368       |
| 0.87 | 870          | 13 403       | 1    | 1 kilo       | 1            |
| 0.88 | 880          | 14 35        |      |              |              |

### Conversion of Kilogrammes into lbs english.

| Kilogrammes<br>into | cwts | qrs | lbs | oz              | Approximate<br>conversion<br>into lbs |
|---------------------|------|-----|-----|-----------------|---------------------------------------|
| 1                   | 0    | 0   | 2   | $3\frac{1}{4}$  | $2\frac{1}{5}$                        |
| 2                   | 0    | 0   | 4   | $6\frac{1}{2}$  | $4\frac{2}{5}$                        |
| 3                   | 0    | 0   | 6   | $9\frac{3}{4}$  | $6\frac{3}{5}$                        |
| 4                   | 0    | 0   | 8   | 13              | $8\frac{4}{5}$                        |
| 5                   | 0    | 0   | 11  | $0\frac{1}{4}$  | 11                                    |
| 6                   | 0    | 0   | 13  | $3\frac{1}{2}$  | $13\frac{1}{5}$                       |
| 7                   | 0    | 0   | 15  | 7               | $15\frac{1}{3}$                       |
| 8                   | 0    | 0   | 17  | $10\frac{1}{4}$ | $17\frac{2}{5}$                       |
| 9                   | 0    | 0   | 19  | $13\frac{1}{2}$ | $19\frac{3}{5}$                       |
| 10                  | 0    | 0   | 22  | $0\frac{3}{4}$  | $22\frac{1}{3}$                       |
| 20                  | 0    | 1   | 16  | $1\frac{1}{2}$  | $44\frac{1}{4}$                       |
| 30                  | 0    | 2   | 10  | $2\frac{1}{2}$  | $66\frac{2}{3}$                       |
| 40                  | 0    | 3   | 4   | 3               | 88                                    |
| 50                  | 0    | 3   | 26  | $3\frac{3}{4}$  | $110\frac{1}{4}$                      |
| 60                  | 1    | 0   | 20  | $4\frac{1}{2}$  | 132                                   |
| 70                  | 1    | 1   | 14  | $5\frac{1}{4}$  | 154                                   |
| 80                  | 1    | 2   | 8   | 6               | 176                                   |
| 90                  | 1    | 3   | 2   | $6\frac{1}{2}$  | 198                                   |
| 100                 | 1    | 3   | 24  | 7               | $220\frac{1}{2}$                      |
| 200                 | 3    | 3   | 20  | 15              | 441                                   |
| 300                 | 5    | 3   | 17  | 6               | $661\frac{1}{3}$                      |
| 400                 | 7    | 3   | 13  | 14              | 882                                   |
| 500                 | 9    | 3   | 10  | 5               | $1102\frac{1}{2}$                     |

## Conversion of grammes into oz and grains.

|                           |                               |         |            |              |
|---------------------------|-------------------------------|---------|------------|--------------|
| 1 grms                    | 15.43235 grs                  | 51 grms | 787.04 grs | 1 oz 350 grs |
| 2 "                       | 30.86470 "                    | 52 "    | 802.48 "   | 1 " 365 "    |
| 3 "                       | 46.29705 "                    | 53 "    | 817.91 "   | 1 " 380 "    |
| 4 "                       | 61.72940 "                    | 54 "    | 833.34 "   | 1 " 395 "    |
| 5 "                       | 77.16175 "                    | 55 "    | 848.77 "   | 1 " 411 "    |
| 6 "                       | 92.59410 "                    | 56 "    | 864.21 "   | 1 " 427 "    |
| 7 "                       | 108.02645 "                   | 57 "    | 879.64 "   | 2 " 005 "    |
| 8 "                       | 123.45880 "                   | 58 "    | 895.07 "   | 2 " 020 "    |
| 9 "                       | 138.89115 "                   | 59 "    | 910.50 "   | 2 " 036 "    |
| 10 "                      | 154.32350 "                   | 60 "    | 925.94 "   | 2 " 051 "    |
| 11 "                      | 169.75585 "                   | 61 "    | 941.37 "   | 2 " 066 "    |
| 12 "                      | 185.18820 "                   | 62 "    | 956.80 "   | 2 " 082 "    |
| 13 "                      | 200.62055 "                   | 63 "    | 972.23 "   | 2 " 097 "    |
| 14 "                      | 216.05290 "                   | 64 "    | 987.67 "   | 2 " 113 "    |
| 15 "                      | 231.48525 "                   | 65 "    | 1003.10 "  | 2 " 128 "    |
| 16 "                      | 246.91760 "                   | 66 "    | 1018.53 "  | 2 " 144 "    |
| 17 "                      | 262.34995 "                   | 67 "    | 1033.96 "  | 2 " 159 "    |
| 18 "                      | 277.78230 "                   | 68 "    | 1049.39 "  | 2 " 174 "    |
| 19 "                      | 293.21465 "                   | 69 "    | 1064.83 "  | 2 " 190 "    |
| 20 "                      | 308.64700 "                   | 70 "    | 1080.26 "  | 2 " 205 "    |
| 21 "                      | 324.07935 "                   | 71 "    | 1095.69 "  | 2 " 220 "    |
| 22 "                      | 339.51170 "                   | 72 "    | 1111.12 "  | 2 " 236 "    |
| 23 "                      | 354.94405 "                   | 73 "    | 1126.56 "  | 2 " 252 "    |
| 24 "                      | 370.37640 "                   | 74 "    | 1141.99 "  | 2 " 267 "    |
| 25 "                      | 385.80875 "                   | 75 "    | 1157.42 "  | 2 " 282 "    |
| 26 "                      | 401.24110 "                   | 76 "    | 1172.85 "  | 2 " 298 "    |
| 27 "                      | 416.67345 "                   | 77 "    | 1188.29 "  | 2 " 313 "    |
| 28 "                      | 432.10580 "                   | 78 "    | 1203.72 "  | 2 " 329 "    |
| 28 <sup>35/100</sup> grms | = 437 <sup>1/2</sup> " = 1 oz | 79 "    | 1219.15 "  | 2 " 344 "    |
| 29 grms                   | = 447.53 grs = 1 oz 10 grs    | 80 "    | 1234.58 "  | 2 " 360 "    |
| 30 "                      | = 462.97 " = 1 " 25 "         | 81 "    | 1250.02 "  | 2 " 375 "    |
| 31 "                      | = 478.40 " = 1 " 41 "         | 82 "    | 1265.45 "  | 2 " 390 "    |
| 32 "                      | = 493.83 " = 1 " 56 "         | 83 "    | 1280.88 "  | 2 " 406 "    |
| 33 "                      | = 509.26 " = 1 " 72 "         | 84 "    | 1296.31 "  | 2 " 421 "    |
| 34 "                      | = 524.69 " = 1 " 87 "         | 85 "    | 1311.74 "  | 2 " 437 "    |
| 35 "                      | = 540.13 " = 1 " 102 "        | 86 "    | 1327.18 "  | 3 " 015 "    |
| 36 "                      | = 555.56 " = 1 " 118 "        | 87 "    | 1342.61 "  | 3 " 030 "    |
| 37 "                      | = 570.99 " = 1 " 133 "        | 88 "    | 1358.04 "  | 3 " 045 "    |
| 38 "                      | = 586.42 " = 1 " 149 "        | 89 "    | 1373.47 "  | 3 " 061 "    |
| 39 "                      | = 601.86 " = 1 " 164 "        | 90 "    | 1388.91 "  | 3 " 076 "    |
| 40 "                      | = 617.29 " = 1 " 180 "        | 91 "    | 1404.34 "  | 3 " 092 "    |
| 41 "                      | = 632.72 " = 1 " 195 "        | 92 "    | 1419.77 "  | 3 " 107 "    |
| 42 "                      | = 648.15 " = 1 " 210 "        | 93 "    | 1435.20 "  | 3 " 123 "    |
| 43 "                      | = 663.59 " = 1 " 226 "        | 94 "    | 1450.64 "  | 3 " 138 "    |
| 44 "                      | = 679.02 " = 1 " 241 "        | 95 "    | 1466.07 "  | 3 " 154 "    |
| 45 "                      | = 694.45 " = 1 " 257 "        | 96 "    | 1481.50 "  | 3 " 169 "    |
| 46 "                      | = 709.88 " = 1 " 272 "        | 97 "    | 1496.93 "  | 3 " 184 "    |
| 47 "                      | = 725.32 " = 1 " 288 "        | 98 "    | 1512.37 "  | 3 " 200 "    |
| 48 "                      | = 740.75 " = 1 " 303 "        | 99 "    | 1527.80 "  | 3 " 215 "    |
| 49 "                      | = 756.18 " = 1 " 319 "        | 100 "   | 1543.23 "  | 3 " 230 "    |
| 50 "                      | = 771.61 " = 1 " 334 "        |         |            |              |

## Conversion of lbs into Kilogrammes.

|               |           |                |            |
|---------------|-----------|----------------|------------|
| 1 lbs Engl. = | 0.454 Ko. | 30 lbs Engl. = | 13.608 Ko. |
| 2 " " =       | 0.907 "   | 31 " " =       | 14.062 "   |
| 3 " " =       | 1.361 "   | 32 " " =       | 14.515 "   |
| 4 " " =       | 1.814 "   | 33 " " =       | 14.969 "   |
| 5 " " =       | 2.268 "   | 34 " " =       | 15.422 "   |
| 6 " " =       | 2.722 "   | 35 " " =       | 15.876 "   |
| 7 " " =       | 3.175 "   | 36 " " =       | 16.330 "   |
| 8 " " =       | 3.629 "   | 37 " " =       | 16.783 "   |
| 9 " " =       | 4.082 "   | 38 " " =       | 17.237 "   |
| 10 " " =      | 4.536 "   | 39 " " =       | 17.690 "   |
| 11 " " =      | 4.990 "   | 40 " " =       | 18.144 "   |
| 12 " " =      | 5.443 "   | 41 " " =       | 18.598 "   |
| 13 " " =      | 5.897 "   | 42 " " =       | 19.051 "   |
| 14 " " =      | 6.350 "   | 43 " " =       | 19.505 "   |
| 15 " " =      | 6.801 "   | 44 " " =       | 19.958 "   |
| 16 " " =      | 7.258 "   | 45 " " =       | 20.412 "   |
| 17 " " =      | 7.711 "   | 46 " " =       | 20.866 "   |
| 18 " " =      | 8.165 "   | 47 " " =       | 21.319 "   |
| 19 " " =      | 8.618 "   | 48 " " =       | 21.773 "   |
| 20 " " =      | 9.072 "   | 49 " " =       | 22.226 "   |
| 21 " " =      | 9.526 "   | 50 " " =       | 22.680 "   |
| 22 " " =      | 9.979 "   | 60 " " =       | 27.216 "   |
| 23 " " =      | 10.433 "  | 70 " " =       | 31.752 "   |
| 24 " " =      | 10.886 "  | 80 " " =       | 36.288 "   |
| 25 " " =      | 11.340 "  | 90 " " =       | 40.824 "   |
| 26 " " =      | 11.794 "  | 100 " " =      | 45.360 "   |
| 27 " " =      | 12.247 "  | 200 " " =      | 90.720 "   |
| 28 " " =      | 12.701 "  | 300 " " =      | 136.080 "  |
| 29 " " =      | 13.154 "  | 400 " " =      | 181.440 "  |
|               |           | 500 " " =      | 226.800 "  |

## Conversion of grains, oz, lbs, qrs, cwts, into Kilogrammes.

|                                          |                                                       |
|------------------------------------------|-------------------------------------------------------|
| 7.716175 grains =                        | 0.5 grammes                                           |
| 15.432350 " =                            | 1.0 "                                                 |
| 154.323500 " =                           | 10.0 "                                                |
| 437 <sup>1</sup> / <sub>2</sub> grains = | 1 oz = 28 <sup>1</sup> / <sub>10</sub> grammes        |
| 16 oz =                                  | 1 lbs = 453.59 "                                      |
| 28 lbs =                                 | 1 qrs = 12 kilos 712 grammes                          |
| 4 qrs =                                  | 1 cwt = 112 lbs = 50 kilos 803 grammes                |
| 20 cwts =                                | 1 ton = 1016.06 kilos.                                |
| 1 oz =                                   | 437 <sup>1</sup> / <sub>2</sub> grs = 28.3502 grammes |
| 2 " =                                    | 875 " = 56.6991 "                                     |
| 3 " =                                    | 1312 <sup>1</sup> / <sub>2</sub> " = 85.0486 "        |
| 4 " =                                    | 1750 " = 113.3981 "                                   |
| 5 " =                                    | 2187 <sup>1</sup> / <sub>2</sub> " = 141.7482 "       |
| 6 " =                                    | 2625 " = 170.0972 "                                   |
| 7 " =                                    | 3062 <sup>1</sup> / <sub>2</sub> " = 198.4466 "       |
| 8 " =                                    | 3500 " = 226.7962 "                                   |

|               |    |                        |               |                  |
|---------------|----|------------------------|---------------|------------------|
| 9 oz          | == | 3937 $\frac{1}{2}$ grs | ==            | 255·1457 grammes |
| 10 "          | == | 4375 "                 | ==            | 283·4952 "       |
| 11 "          | == | 4812 $\frac{1}{2}$ "   | ==            | 311·8448 "       |
| 12 "          | == | 5250 "                 | ==            | 340·1942 "       |
| 13 "          | == | 5687 $\frac{1}{2}$ "   | ==            | 368·5438 "       |
| 14 "          | == | 6125 "                 | ==            | 396·8933 "       |
| 15 "          | == | 6562 $\frac{1}{2}$ "   | ==            | 425·2428 "       |
| 16 "          | == | 7000 "                 | ==            | 453·5923 "       |
| 1 milligramme | == |                        | 0·001 grammes |                  |
| 1 centigramme | == |                        | 0·01 "        |                  |
| 1 decigramme  | == |                        | 0·1 "         |                  |
| 1 decagramme  | == |                        | 10·000 "      |                  |
| 1 hectogramme | == |                        | 100·000 "     |                  |
| 1 kilogramme  | == |                        | 1000·000 "    |                  |

## Conversion of grammes per litre into ounces per gallon.

| Per litre |     | Per gall.             |  |                              |
|-----------|-----|-----------------------|--|------------------------------|
| gram.     | 1   | 4 $\frac{1}{2}$ grms. |  | $\frac{1}{6}$ oz.            |
| grms.     | 2   | 9 "                   |  | $\frac{1}{3}$ "              |
| "         | 3   | 13 $\frac{1}{2}$ "    |  | $\frac{1}{2}$ "              |
| "         | 4   | 18 "                  |  | $\frac{2}{3}$ "              |
| "         | 5   | 22 $\frac{1}{2}$ "    |  | $\frac{5}{6}$ "              |
| "         | 6   | 27 "                  |  | 1 "                          |
| "         | 7   | 31 $\frac{1}{2}$ "    |  | 1 $\frac{1}{6}$ "            |
| "         | 8   | 36 "                  |  | 1 $\frac{1}{3}$ "            |
| "         | 9   | 40 $\frac{1}{2}$ "    |  | 1 $\frac{1}{2}$ "            |
| "         | 10  | 45 "                  |  | 1 $\frac{2}{3}$ "            |
| "         | 11  | 49 $\frac{1}{2}$ "    |  | 1 $\frac{5}{6}$ "            |
| "         | 12  | 54 "                  |  | 2 "                          |
| "         | 13  | 58 $\frac{1}{2}$ "    |  | 2 $\frac{1}{6}$ "            |
| "         | 14  | 63 "                  |  | 2 $\frac{1}{3}$ "            |
| "         | 15  | 67 $\frac{1}{2}$ "    |  | 2 $\frac{1}{2}$ "            |
| "         | 16  | 72 "                  |  | 2 $\frac{2}{3}$ "            |
| "         | 17  | 76 $\frac{1}{2}$ "    |  | 2 $\frac{5}{6}$ "            |
| "         | 18  | 81 "                  |  | 3 "                          |
| "         | 19  | 85 $\frac{1}{2}$ "    |  | 3 $\frac{1}{6}$ "            |
| "         | 20  | 90 "                  |  | 3 $\frac{1}{3}$ "            |
| "         | 30  | 135 "                 |  | 5 "                          |
| "         | 40  | 180 "                 |  | 6 $\frac{2}{3}$ "            |
| "         | 50  | 225 "                 |  | 8 $\frac{1}{3}$ "            |
| "         | 60  | 270 "                 |  | 10 "                         |
| "         | 70  | 315 "                 |  | 11 $\frac{2}{3}$ "           |
| "         | 80  | 360 "                 |  | 13 $\frac{1}{3}$ "           |
| "         | 90  | 405 "                 |  | 15 "                         |
| "         | 100 | 450 "                 |  | 16 $\frac{2}{3}$ "           |
| "         | 200 | 900 "                 |  | 32 $\frac{1}{3}$ "           |
| "         | 300 | 1350 "                |  | == 2 lbs 1 $\frac{1}{4}$ oz. |
| "         | 400 | 1800 "                |  | == 3 " 2 "                   |
| "         | 500 | 2250 "                |  | == 4 " 2 $\frac{2}{3}$ "     |
| "         |     |                       |  | == 5 " 3 $\frac{1}{3}$ "     |

## Fluid Measures.

|                                                  | pints               | quarts         | gallons             | litres                                 |
|--------------------------------------------------|---------------------|----------------|---------------------|----------------------------------------|
|                                                  | 2 =                 | 1              |                     |                                        |
|                                                  | 8 =                 | 4 =            | 1 =                 | 4.543                                  |
| 1 Imp. gallon =                                  | 8 pints =           | 32 gills =     | 160 oz =            | 4 kil. 540 grms.                       |
|                                                  | 1 „ =               | 4 „ =          | 20 „ =              | 0 „ 567 „                              |
| In English works 2 noggins = 1 gill (10 fl. oz.) |                     |                |                     |                                        |
|                                                  |                     | 2 gills =      | 1 pint.             |                                        |
| In Scotch works 4 gills = 1 pint                 |                     |                |                     |                                        |
|                                                  | (of 5 fl. oz. each) |                | (20 fl. oz.)        |                                        |
| 1 U. S. gallon =                                 | 3.785               | litres         |                     |                                        |
| 1 Imp. „ =                                       | 4.5436              | litres =       | 4543                | cubic centimetres                      |
| 1 „ =                                            |                     | water =        | 10                  | lbs Engl.                              |
| 1000 Imp. gallons =                              | 10015               | lbs Engl. =    | 4543                | kilo                                   |
| 210 „ =                                          |                     | water =        | 1 ton =             | 35.943 cubic feet                      |
| 1 „ =                                            |                     |                | 277 1/4             | cubic inch. = 0.16 cubic feet = 10 lbs |
|                                                  |                     | 1 Imp. pipe =  | 572.48              | litres                                 |
|                                                  |                     | 1 U. S. pipe = | 476.94              | „                                      |
| 1 litre =                                        | 100                 | centilitres =  | 1 cubic decimetre = | 1.76 Imp. pint                         |
|                                                  |                     |                | [= 2.114            | U. S. pints.                           |
| 1 hectolitre =                                   | 10                  | decalitres =   | 100                 | litres.                                |

## Conversion of gallons, pints and gills into lbs and oz.

|                                 |       |                     |
|---------------------------------|-------|---------------------|
| 1 gallon =                      | 10    | lbs                 |
| 100 gallons =                   | 1000  | „                   |
| 1 pint =                        | 1 1/4 | lbs                 |
| 2 pints =                       | 2 1/2 | „                   |
| 3 „ =                           | 3 3/4 | „                   |
| 4 „ =                           | 5     | „                   |
| 5 „ =                           | 6 1/4 | „                   |
| 6 „ =                           | 7 1/2 | „                   |
| 7 „ =                           | 8 3/4 | „                   |
| 8 „ =                           | 10    | „                   |
| 1 pint =                        |       | 2 gills = 1 1/4 lbs |
| 1 quart = 2 pints =             |       | 4 „ = 2 1/2 „       |
| 1 gallon = 4 quarts = 8 pints = | 32    | „ = 10 „            |

## Conversion of litres into gallons and pints.

| Litres | Gallons | Pints | Gills  |
|--------|---------|-------|--------|
| 1      | ==      | 1     | 3·0430 |
| 2      | ==      | 3     | 2·0864 |
| 3      | ==      | 5     | 1·1296 |
| 4      | ==      | 7     | 0·1728 |
| 5      | ==      | 8     | 3·2160 |
| 6      | ==      | 2     | 2·2592 |
| 7      | ==      | 4     | 1·3024 |
| 8      | ==      | 6     | 0·3456 |
| 9      | ==      | 7     | 3·3888 |
| 10     | ==      | 1     | 2·4320 |
| 11     | ==      | 3     | 1·4752 |
| 12     | ==      | 5     | 0·5184 |
| 13     | ==      | 6     | 3·5616 |
| 14     | ==      | 0     | 2·6048 |
| 15     | ==      | 2     | 1·6480 |
| 16     | ==      | 4     | 0·6912 |
| 17     | ==      | 5     | 3·7344 |
| 18     | ==      | 7     | 2·7776 |
| 19     | ==      | 1     | 1·8208 |
| 20     | ==      | 3     | 0·8640 |
| 21     | ==      | 4     | 3·9072 |
| 22     | ==      | 6     | 2·9504 |
| 23     | ==      | 0     | 1·9936 |
| 24     | ==      | 2     | 1·0368 |
| 25     | ==      | 4     | 0·0800 |
| 50     | ==      | 0     | 0·1600 |
| 75     | ==      | 4     | 0·2400 |
| 100    | ==      | 0     | 0·3200 |

## Conversion of Cubic Centimetres into English Measures.

|                     |    |            |    |                         |                                         |
|---------------------|----|------------|----|-------------------------|-----------------------------------------|
| 1 cubic centimetres | == | 17 minims. |    |                         |                                         |
| 2                   | == | 34         | ,, |                         |                                         |
| 3                   | == | 51         | ,, |                         |                                         |
| 4                   | == | 68         | ,, | or 1 drachm             | 8 minims                                |
| 5                   | == | 85         | ,, | 1                       | 25                                      |
| 6                   | == | 102        | ,, | 1                       | 42                                      |
| 7                   | == | 119        | ,, | 1                       | 59                                      |
| 8                   | == | 136        | ,, | 2 drachms               | 16                                      |
| 9                   | == | 153        | ,, | 2                       | 33                                      |
| 10                  | == | 170        | ,, | 2                       | 50                                      |
| 20                  | == | 340        | ,, | 5                       | 40                                      |
| 30                  | == | 510        | ,, | 1 ounce                 | 0 drachm 30 minims.                     |
| 40                  | == | 680        | ,, | 1                       | 3                                       |
| 50                  | == | 850        | ,, | 1                       | 6                                       |
| 60                  | == | 1020       | ,, | 2                       | 1                                       |
| 70                  | == | 1190       | ,, | 2                       | 3                                       |
| 80                  | == | 1360       | ,, | 2                       | 6                                       |
| 90                  | == | 1530       | ,, | 3                       | 1                                       |
| 100                 | == | 1700       | ,, | 3                       | 4                                       |
| 1000                | == | 1 litre    | == | 34 fluid ounces nearly, | or 1 <sup>3</sup> / <sub>4</sub> pints. |



## Conversion of gallons into litres.

|                |               |                 |                |
|----------------|---------------|-----------------|----------------|
| 1 Imp. gallons | 4·5436 litres | 40 Imp. gallons | 181·744 litres |
| 2     "     =  | 9·0872     "  | 50     "     =  | 227·180     "  |
| 3     "     =  | 13·6303     " | 60     "     =  | 272·616     "  |
| 4     "     =  | 18·1748     " | 70     "     =  | 318·052     "  |
| 5     "     =  | 22·718     "  | 80     "     =  | 363·488     "  |
| 6     "     =  | 27·2616     " | 90     "     =  | 408·924     "  |
| 7     "     =  | 31·8052     " | 100   "     =   | 454·360     "  |
| 8     "     =  | 36·3488     " | 200   "     =   | 908·720     "  |
| 9     "     =  | 40·8924     " | 300   "     =   | 1363·080    "  |
| 10   "     =   | 45·436     "  | 400   "     =   | 1817·440    "  |
| 20   "     =   | 90·872     "  | 500   "     =   | 2271·800    "  |
| 30   "     =   | 136·308    "  | 1000   "    =   | 4543·600    "  |

## Water quantities.

|                                    |                    |                |
|------------------------------------|--------------------|----------------|
| 1 pint                             | 34·65 cubic inches | 1¼ lbs         |
| 1 quart                            | 69·31     "        | 2½     "       |
| 1 gallon                           | 277¼     "         | 10     "       |
| 1 bushel                           | 2·218⅓   "         | 80     "       |
| 1 cubic inch                       | —                  | = 0·0361     " |
| 1     "     foot                   | 1·728     "        | = 62·5     "   |
| 1     "     "                      | 6·25     gallons   |                |
| 1 cylindrical foot                 | 4·893     "        |                |
| 1 cubic yard                       | 168·264   "        |                |
| 1 ton of water                     | 35·76 cubic feet   | = 224 Gallons  |
| 1 bushel of water would fill a box | 12" × 12" × 15⅓"   |                |
| 1 peck     "     "     "           | 8" × 8" × 8⅔"      |                |
| 1 gallon   "     "     "           | 6" × 6" × 7¾"      |                |
| 1 quart    "     "     "           | 4" × 4" × 4⅓"      |                |

Water occupies the least space when at 4° C. or 39° F.

## Conversion of Metres into Yards

|         |              |
|---------|--------------|
| 1 metre | 1·0936 Yards |
| 2     " | 2·187     "  |
| 3     " | 3·281     "  |
| 4     " | 4·374     "  |
| 5     " | 5·468     "  |
| 6     " | 6·562     "  |
| 7     " | 7·655     "  |
| 8     " | 8·749     "  |
| 9     " | 9·843     "  |
| 10   "  | 10·936    "  |
| 20   "  | 21·873    "  |

## Conversion of Yards into Metres

|         |                |
|---------|----------------|
| 1 yard  | 0·91438 Metres |
| 2     " | 1·8288     "   |
| 3     " | 2·7432     "   |
| 4     " | 3·6576     "   |
| 5     " | 4·5720     "   |
| 6     " | 5·4864     "   |
| 7     " | 6·4008     "   |
| 8     " | 7·3152     "   |
| 9     " | 8·2296     "   |
| 10   "  | 9·1440     "   |
| 20   "  | 18·2880    "   |

|          |         |       |         |   |          |        |
|----------|---------|-------|---------|---|----------|--------|
| 30 metre | 32·809  | Yards | 30 yard | = | 27·4320  | Metres |
| 40 "     | 43·745  | "     | 40 "    | = | 36·5760  | "      |
| 50 "     | 54·682  | "     | 50 "    | = | 45·7200  | "      |
| 60 "     | 65·618  | "     | 60 "    | = | 54·8640  | "      |
| 70 "     | 76·554  | "     | 70 "    | = | 64·0080  | "      |
| 80 "     | 87·491  | "     | 80 "    | = | 73·1520  | "      |
| 90 "     | 98·427  | "     | 90 "    | = | 82·2960  | "      |
| 100 "    | 109·363 | "     | 100 "   | = | 91·4400  | "      |
| 200 "    | 218·727 | "     | 200 "   | = | 182·8800 | "      |
| 300 "    | 328·090 | "     | 300 "   | = | 274·3200 | "      |
| 400 "    | 437·453 | "     | 400 "   | = | 365·7600 | "      |
| 500 "    | 546·816 | "     | 500 "   | = | 457·2000 | "      |

| Metre Denominations. |                      |                 | Equivalents in the<br>standard of Canada.  |
|----------------------|----------------------|-----------------|--------------------------------------------|
|                      | cubic-<br>metres     | litres          | Imp. gallons and<br>decimal parts of same. |
| kilolitre            | 1                    | 1000            | 220.244                                    |
| hectolitre           | $\frac{1}{10}$       | 100             | 22.0244                                    |
| decalitre            | $\frac{1}{100}$      | 10              | 2.2024                                     |
| litre                | $\frac{1}{1000}$     | 1               | 0.2202                                     |
| decilitre            | $\frac{1}{10\,000}$  | $\frac{1}{10}$  | 0.0220                                     |
| centilitre           | $\frac{1}{100\,000}$ | $\frac{1}{100}$ | 0.0022                                     |

## How to determine the capacity of a square dye-vessel.

What is the capacity of a square dye-vessel if it is for instance  $8 \times 3 \times 3$  feet?

Determine the cubic content and then multiply by 6·25 as a cubic foot of water contains 6·25 gallons.

1 gallon of water equals 10 lbs  
therefore 1 cubic foot of water equals  $62\frac{1}{2}$  lbs or 1000 oz  
and 446·4 gallons equal 4464 lbs.

Dimensions of the dye vessel.

8 feet long

3 " wide

3 " high

or  $8 \times 3 \times 3 = 72$  cubic feet  $\times 6\cdot25$  gallons = 446·4 gallons.

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